Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region

1994 Annual Report

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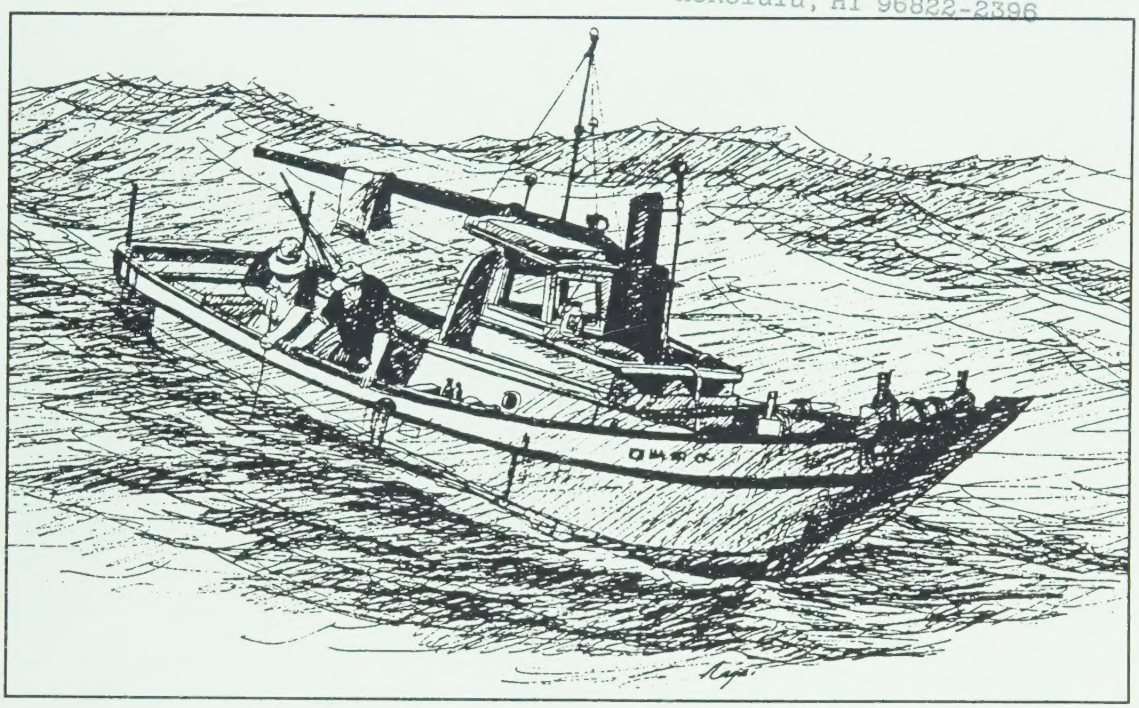

August 1995

Western Pacific Regional Fishery Management Council
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for the

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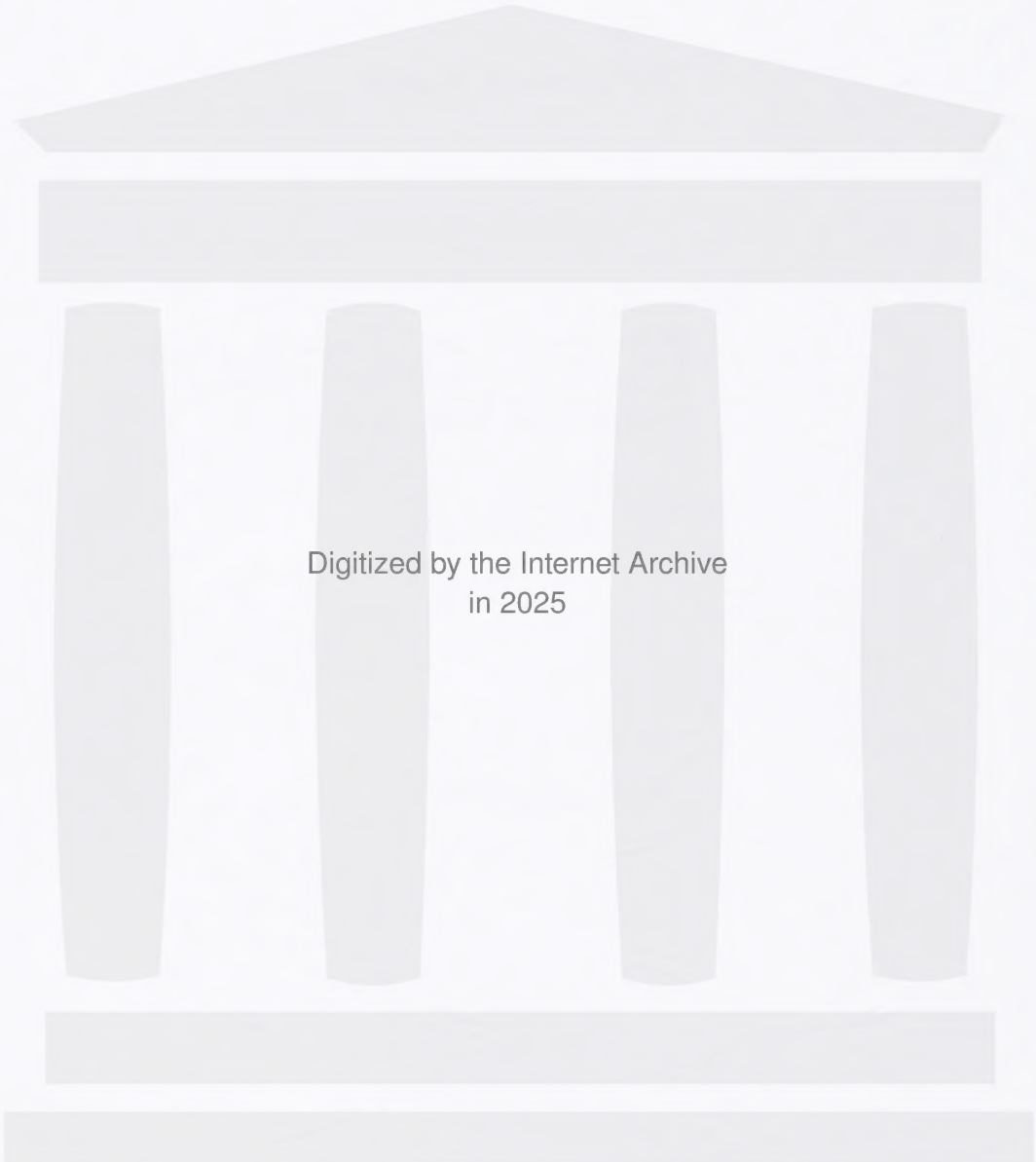

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Bottomfish and Seamount Groundfish Fisheries of the Western Pacific

1994 Annual Report

1.0 INTRODUCTION

The 1994 annual report provides a set of descriptors and indicators of the bottomfish fisheries from American Samoa, Guam, Hawaii and the Northern Mariana Islands. The descriptors are designed to document recent trends in landings, effort, participation, revenue and prices. Should management action be recommended, descriptor information will aid in assessing potential impacts of the action on fishery participants. The indicators are quantifiable and measurable tools used to identify signs of stress in the stocks or the fishery. Based on changes over time in indicator levels, the Bottomfish Plan Team (BPT) may identify "yellow light" situations (i.e., where stress is first detected) and recommend that either management action or additional study be undertaken.

The annual report is organized as follows: The introduction section defines and briefly explains the descriptors and indicators. The next section briefly summarizes time trends in descriptor and indicator levels, through the current year, and recommends any areas of concern for each island area. Reports from each island area are appended. The introduction describes the history and present characteristics of the fishery. Results of the year's descriptors and indicators are presented in detail, in relation to past temporal trends. Figures are supported with information on source of the data, methods of calculation, and data interpretation. Table 1 summarizes 1994 bottomfish statistics for the region. The appended report from each area concludes with a summary, which addresses progress made on the previous year's recommendations, and new recommendations. Finally, additional appendices contain information on NMFS 1994 administrative and enforcement activities, habitat conditions, protected species interactions, and 1994 BPT membership.

Table 2 lists scientific, common English and local/indigenous names for bottomfish management unit species for each area (American Samoa, Guam/Northern Marianas, and Hawaii).

1.1 Definition of Descriptors

The fishery descriptors are defined as follows:

1.1.1 Landings information

Time series information on aggregate catch for each island area shows recent trends in total bottomfish harvest. For American Samoa and Guam, estimates of both the commercial landings and the total landings (combined commercial, recreational and subsistence) are available. For Hawaii and the Northern Marianas, landings information represents only the commercial harvest.

Table 1. Regional Summary of 1994 Bottomfish Statistics

				HI			
	AS	GU	MP	All	MHI	Mau	Hoomalu
BMUS Landings (lb)[1]	31,679	49,169	20,363	917,192	457,960	177,826	281,406
Revenue ($)[1]	79,536	104,827	56,405	2,900,575	1,506,688	518,188	875,699
No. of Boats	21	268	32	--	414	12	5
No. of Trips	238	3056	275	--	5,907	80	41
CPUE	13.1 lb/hr	6.7 lb/hr	74 lb/trip	--	228 lb/trip	385 lb/day	625 lb/day
SPR	0.44	--	--	--	*[2]	*[3]	*[3]

1) Regional totals (all areas): Landings = 1,018,403 lb; Revenue = $3,141,343
2) Species with Spawning Potential Ratio near or below critical level of 0.20 (recruitment overfished): onaga (SPR = 0.14); opakapaka (SPR = 0.24)
3) Healthy (SPR > 0.20) for all species

Table 2. Bottomfish Management Unit Species (BMUS) Names

(Absence of an indigenous name implies no local name established or area is not within the species' geographic range.)

Scientific	English Common	American Samoa	Guam/CNMI	Hawaii
Bottomfish:				
Aphareus rutilans	red snapper/silvermouth	palu-gutusiliva	maraap tatoong	lehi
Aprion virescens	gray snapper/jobfish	asoama	tosan	uku
Caranx ignobilis	giant trevally/jack	sapoanae	tarakito	white ulua/pau'u
C. lugubris	black trevally/jack	tafauli	trankiton attilong	black ulua
Epinephelus fasciatus	blacktip gouper	fausi	gadao matai	
E. quernus	sea bass			hapu'upuu
Etelis carbunculus	red snapper	palu-malau	guihan boninas	ehu
E. coruscans	red snapper	palu-loa	onaga	onaga
Lethrinus amboinensis	ambon emperor	filoa-gutumumu	mafuti/lililok	
L. rubrioperculatus	redgill emperor	filoa-pa'o'omumu	mafuti tatdong	
Lutjanus kasmira	blueline snapper	savane	sas/funai	ta'ape
Pristipomoides auricilla	yellowtail snapper	palu-i'usama	guihan boninas	yellowtail kalekale
P. filamentosus	pink snapper	palu-'ena'ena	guihan boninas	opakapaka
P. flavipinnis	yelloweye snapper	palu-sina	guihan boninas	yelloweye opakapaka
P. seiboldi	pink snapper		guihan boninas	kalekale
P. zonatus	snapper	palu-sega	guihan boninas/gindai	gindai
Pseudocaranx dentex	thicklip trevally		terakito	butaguchi/pig ulua
Seriola dumerili	amberjack		guihan tatdong	kahala
Variola louti	lunartail grouper	papa	bueli	
Seamount Groundfish:				
Beryx splendens	alfonsin			kinmedai (Japanese)
Hyperoglyphe japonica	ratfish/butterfish			medai (Jap.)
Pseudopentaceros richardsoni	armorhead			kusakari tsubodai (Jap.)

In Hawaii, changes in species catch composition are provided for the Main Hawaiian Islands (MHI) and the Northwestern Hawaiian Islands (NWHI). Statistical tests for consistency in catch composition over time and between areas are included. Where possible, descriptor information has been presented for each NWHI management zone: Hoomalu and Mau. For 1994, pounds landed by species are presented in tabular form for each area except Hawaii. For Hawaii, NWHI bottomfish management unit species (BMUS) landings by species are provided for 1986 through 1994.

1.1.2 Effort information

Effort is measured in number of trips for Hawaii and the Northern Marianas, and in both hours fished and trips taken for American Samoa and Guam.

1.1.3 Participation information

Estimates of the number of vessels making bottomfish landings are provided for all areas.

1.1.4 Economic information

Time trends in economic performance are characterized by plots of total ex-vessel revenue, aggregate average price levels, and for Hawaii, price trends over time for major species. In time-series of prices and revenues, it is appropriate to adjust value for the rate of inflation so that values throughout the time period are comparable (based on a consistent purchasing power for the dollar). Both the unadjusted and adjusted aggregate average price and aggregate revenues are plotted to clarify the relative change over time.

1.2 Definition of Indicators

Indicators were developed as tools for identifying signs of stress in the stocks or the fishery which deserve further investigation and/or a management response. Analyses consider how the indicators change over time. Indicators from Hawaii include 95% confidence intervals. To the degree possible, similar variance estimates are expected from the other areas in future annual reports. The indicators are defined as follows:

1.2.1 Aggregate Catch-Per-Unit-Effort

If the current year's aggregate catch-per-unit-effort (CPUE) is less than 50% of the average aggregate CPUE for the first three years of available data, there may be cause for concern. CPUE information is available for all areas; research CPUE is available for SE Hancock Seamount for all years since 1985, except 1992 and 1994.

1.2.2 Mean Fish Size

If there has been a significant reduction in mean fish size for a species over time, the stock may be stressed by the fishery. Mean size information is provided for nine species in Hawaii. No mean size information was available at this time for American Samoa, Guam or the Northern Marianas.

1.2.3 Percent Immature

If over 50% of the catch for a species is below the size of first maturity, the stock may be stressed by the fishery. Information for this indicator is available only from Hawaii.

1.2.4 Spawning Potential Ratio

The spawning potential ratio (SPR) is the ratio of the spawning stock biomass per recruit, at the current level of fishing, to the spawning stock biomass per recruit that would occur in the absence of fishing. According to the overfishing definition contained in the Bottomfish FMP (Amendment 3, 1990), if SPR is less than or equal to 0.20, recruitment overfishing has occurred (i.e., spawners have been reduced to 20%, or less, of their unexploited stock level). Data to calculate SPR were not available from Guam or the Northern Marianas. An estimate of the "worst case" SPR was calculated for American Samoa's bottomfish complex using Dory Project data to estimate the virgin population CPUE and information on percent of immature fish from Hawaii. In Hawaii, SPR was calculated for five major species in the Hoomalu and Mau Zones, of the NWHI, and the MHI; some SPR values changed slightly from previous year's reports due to improvement in the calculations. SPR for armorhead was calculated annually since 1985, except for 1992 and 1994.

1.2.5 Economic Indicators

Revenue per trip plots are presented for all areas except the MHI. A more valuable indicator for the commercial fisheries, which may be available in the future, would be net revenue (ex-vessel revenue minus costs per trip).

2.0 AREA SUMMARIES

2.1 American Samoa

2.1.1 Descriptors

Bottomfish landings, which declined from 1988 to 1992, rose slightly in 1993 and dramatically in 1994. The decline was attributed to the following: the three hurricanes that struck the territory (in 1987, 1990 and 1991), the departure of several highliners from the fishery, the shift in importance from bottomfishing to trolling, and the substitution of imported fish from Western Samoa and Tonga. The 1994 rise occurred primarily due to improved catch

recording, an increase in effort by highline vessels, and a high fish demand for government and cultural events. The 1994 total landings increased 125% compared to the previous year.

Fishing effort, measured by the number of trips, reversed a four-year decline and increased by 138% in 1994. Total hours of fishing effort doubled from 1993 to 1994 (a 102% increase). These notable increases are primarily due to improved sampling, a significant rise in activity by the Manua fleet (which almost tripled), and the increased effort by highline vessels.

The average price per pound reached its highest point in 1994 since 1983. This rise is consistent with a general increasing trend since 1985. Inflation-adjusted values have experienced fluctuations no greater than 11% from 1985-1994, with the 1994 average price near the high end of the range. Prices of locally caught fish were kept low due to the large amount of imports.

2.1.2 Indicators

CPUE (pounds per hour), relatively stable (at about 10 lb/hr) in the early 1990's, has increased the last two years (up 15% in 1994) indicating a healthy fishery. The proxy "worst case" SPR was 0.44 in 1994, indicating that recruitment overfishing has not occurred. Size and maturity data were collected from key species, but insufficient sample sizes were available for a more realistic SPR estimation. Bottomfish revenue per bottomfish trip (as opposed to total revenue) increased 15% in 1994. It does not foreshadow a burgeoning industry, however, since cheaper imported bottomfish continuously flood local markets.

2.1.3 Recommendations

1) Available data do not indicate any problems with the bottomfish fishery or stocks in American Samoa. The plan team recommends that a biologist (as opposed to local technicians) be responsible for the fish dissections and gonad analyses and recording of data for the length and maturity data collection program initiated by the BPT.

2) Cash to buy fish samples should be readily available.

3) The BPT finds that the length and maturity data program should continue and be made a high priority as the information collected is crucial for SPRs to be estimated more reliably, with data exclusively from American Samoa.

2.2 Guam

2.2.1 Descriptors

The fairly large fluctuations over time in bottomfish landings in Guam appear to be due more to entry and exit patterns of fishermen, rather than changes in fish stocks. The number

of highliners fishing doubled from 1993 to 1994. A 64% average increase in the number of vessels bottomfish fishing is mirrored by the 64% average increase in total and commercial BMUS landings in 1993-94, over the preceding two years.

Although bottomfish landings increased 6% in 1994, and commercial BMUS catch increased three-fold (total BMUS harvest remained stable), the total number of boat trips dropped 51% and the total number of boat hours dropped 23%. The total number of participating vessels remained stable. The 1994 values for total trips and number of boats are lower because the appearance of additional highliners with a larger commercial capacity and the unusually calm seas of 1993 (which inflated effort) did not re-occur. The 1994 statistics are, however, representative of a general increasing trend which began in 1986.

The adjusted average price for bottomfish has not shown consistent marketing trends. This is believed to have resulted from the seasonal supply of pelagic fish and difficulties in developing a consistent market for locally caught fish. In addition, imported fish from other islands around the region have contributed to the continued marketing problem for local fishermen.

2.2.2 Indicators

The CPUE has fluctuated between 5-8 lb/hr, but has been fairly stable for the past nine years, settling at 6.7 lb/hr in 1994. Overall, no problem is indicated by CPUE.

The adjusted average revenue per trip does not appear to show any long-term trend or cause for concern. The substantial increases in both actual and inflation adjusted revenue per trip occurring in 1994 are best explained by the success of the highliner vessels.

2.2.3 Recommendations

1) Recognizing that the 1991 through 1994 annual reports are incomplete by not being representative of the data analyses required, and that this deficiency continues to jeopardize confidence in the data presented for Guam, an effort to rectify this shortcoming should be pursued quickly and the analyses of the available data eventually be repeated by computerized expansion. Finalization of the contract to develop a customized computer program that will adequately process the data should be completed by the end of FY 1995.

2) The need to complete a baseline biological survey of the red-gilled emperor (*Lethrinus rubrioperculatus*) remains as the single most important data deficiency for the Marianas shallowater bottomfish resource. Thus, the previous recommendation, in the 1992 and 1993 Guam annual reports, to establish a joint program with the CNMI, continues to be a priority; especially in light of the fact that the window of opportunity to conduct such a project with the CNMI's virgin stocks is rapidly closing as commercial bottomfishing operations continue to grow in number and increase their fishing effort.

3) With the assistance of the National Marine Fisheries Service, calculate the spawning potential ratio (SPR) for Guam's deep *and* shallowater bottomfish complexes.

4) Further investigate reports of local highliners who fish in CNMI waters but land their catch in Guam. Based on two interviews that were obtained in 1994, the survey expansion resulted in an estimate of 11 trips and 10,413 pounds of bottomfish, approximately 13% of Guam's total bottomfish landings, being caught in CMNI waters by Guam-based fishermen and landed on Guam.

2.3 Hawaii

2.3.1 Descriptors

Main Hawaiian Islands: Only commercial data are available for both the MHI and NWHI fisheries, even though in the MHI recreational/subsistence catch is estimated to be about equal that of commercial landings. In 1988, there was a dramatic increase in MHI bottomfish landings due to a bonanza uku (gray snapper) harvest. Since that time there has been a steady decline in total landings, which stabilized from 1990-1992. Landings in 1994 went up 32% over 1993 (which was the lowest recorded annual value), but remained for the second straight year below those of the NWHI. The increase in MHI landings reflects an increase in effort, while the standardized number of vessels decreased in 1994.

Total ex-vessel revenue from the MHI has shown a general decline from 1988-1994, mainly due to decreased landings, but inflation-adjusted average price appears to be relatively stable in recent years.

NWHI Mau Zone: Mau Zone 1994 landings have increased 81% over 1993. The total number of boats increased 50% to 12, while the number of trips increased by 11%. In addition, bottomfish landings per trip increased by 43%.

NWHI Hoomalu Zone: Hoomalu Zone 1994 landings decreased slightly from 1993. Five total boats fished in the zone (one more than last year), while the number of trips increased by 17%. In addition, bottomfish landings per trip decreased by 18%.

Available revenue data are not separated by zone. Overall NWHI inflation-adjusted revenue has been relatively stable since 1990. Inflation-adjusted average bottomfish price appears to be relatively stable in recent years.

2.3.2 Indicators

MHI: Following the previous year's drop in CPUE, in 1994 it increased back to its 1992 level. Recent CPUE values are about a third of early (baseline) values, signifying a yellow-light condition in the MHI. This indicator suggests that ehu is the most stressed species with a recent CPUE of only 11% that of the initial years of the fishery. The increase in the

late 1980's MHI CPUE was primarily due to a large increase in uku catches, and may not indicate an increase in abundance in other species. Most of the more commercially important species in the MHI have had relatively stable mean weights since 1984. Hapuupuu's mean weight (which dropped sharply in 1993) in 1994 was still less than prior years, though not drastically so. Also, the sample size was small (only 2.5% of the catch). MHI onaga again had the highest percentage of immature fish, and was the only species where over 50% of the catch was consistently immature, signifying a yellow light condition.

For the second year 95% confidence intervals were constructed based on "best" and "worst" case bounds of SPR components (CPUE and percent immature). Of the five major species for which the SPR indicator was calculated, only onaga was below the 0.20 "critical" level, indicative of recruitment overfishing, while opakapaka approached this level (SPR = 0.24), followed by ehu with an SPR of 0.29. Onaga's SPR has now been below 0.20 for the past six years (with an average of 0.14), indicating a red light situation for this species. Peak SPR values in 1988-89 were largely due to increases in aggregate CPUE due to increased uku landings.

NWHI Mau Zone: The NMFS CPUE data are only available for the NWHI fishery as a whole since 1984 and by zone since 1988. The NWHI (combined Mau and Hoomalu Zones) NMFS CPUE steadily decreased from 1987 to 1992, rose in 1993, and then dropped to an all-time low of 472 lb/day in 1994, which is 64% of the average of the first 3 years (739 lb/day, 1984-86). This could be the result a return to normal abundance, rather than a decrease in normal fish abundance; but it could also represent declines in some stocks. The reasons are currently unclear. The Mau Zone NMFS CPUE had been steadily decreasing since 1989, but increased 44% in 1994 to 385 lb/day, for reasons unknown. The Mau Zone HDAR CPUE increased 88% from 1993, with the 1994 value only 63% of the average of the first three years (5,911 lb/trip, 1948-50). Non-parametric 95% confidence intervals were calculated for HDAR CPUEs by the "bootstrapping" method. Mean weights of fish in the Mau Zone continue to exhibit year to year fluctuations, but are generally at much higher values than MHI mean weights. The percent of immature fish in the 1993 Mau Zone catch was still safely under 50% for all species evaluated.

The SPR values in the Mau Zone had been decreasing since 1990 (mirroring the pattern in the HDAR CPUE) but experienced a surprising rise in 1994. All values are presently above 0.64. Mau Zone SPR estimates were equal to or higher than Hoomalu zone estimates, which has not happened in recent years. SPR values are higher in the NWHI than the MHI because most of the catch is mature fish. SPR values in both NWHI zones have never fallen below 0.35.

NWHI Hoomalu Zone: The Hoomalu Zone NMFS CPUE has been on a downward trend since 1988, reaching its lowest point in 1994. The Hoomalu Zone HDAR CPUE followed an increasing trend, but dropped sharply (down 42%) in 1994 for unclear reasons. The 4,626 lb/trip was 55% of the average of the first three years (8,440 lb/trip, 1948-50). Mean weights of fish in the Hoomalu Zone continued to exhibit year to year fluctuations, but

are still at much higher values than MHI mean weights. The percent of immature fish in the 1993 catch was still safely under 50% for all species evaluated.

The SPR values in the Hoomalu Zone dropped dramatically in 1994, with four of the five measured species reaching its lowest value ever, while all 1994 values are above 0.60.

Seamount Groundfish (Armorhead): No fishing has been allowed on the armorhead stocks of the SE Hancock Seamount since the moratorium began in August, 1986. The 1993 CPUE, calculated from research longline catches, was more than double that of the last assessment (in 1991) and nearly as high as the highest CPUE recorded since surveying began in 1985. No research cruise occurred in 1994 and future research assessment cruises are unlikely.

No SPR values were available in 1994 as no research was undertaken. In 1993, SPR within the EEZ (SE Hancock Seamount) was above 0.02, the highest since 1986, but still far below (10% of) the threshold level for recruitment overfishing of 0.20. About 99% of the known armorhead seamount habitat occurs outside the EEZ, an area which had 0.06 SPR in 1993. A Japanese research trawl of the seamounts outside the US EEZ is planned for August 1995.

2.3.3 Recommendations

1) The BPT remains concerned about the continuing overfished condition of the MHI onaga and ehu stocks. The BPT supports the ongoing efforts of the DLNR bottomfish task force toward establishing management regulations for the MHI fishery and anticipates a timely solution.

2) Again, the BPT strongly encourages the State to proceed expeditiously with computerization of the fish and seafood dealer reporting system and integrate this with the fishermen's commercial catch reporting system.

3) Again, the BPT strongly encourages NMFS and the State to increase the level of bottomfish catch monitoring of the Honolulu auction (reduced from 6 to 2 days per week) and expand this sampling to major dealers on all other main Hawaiian Islands.

2.4 Northern Mariana Islands

2.4.1 Descriptors

Data are available only on the commercial fishery. The declining trend in landings and revenues, which occurred from 1988-91, has been reversed by a growth trend that began in 1992. Landings in 1994 were up 38%, due to growth of the local bottomfishing industry, particularly from new ventures operating full time. The number of vessels fishing increased

60% in 1994, to 32. This increase has been in vessels of all sizes, including large (50 ft plus) vessels. The number of trips increased 54%, reaching the highest level since 1985.

The average price received for bottomfish increased slightly (19%) to $2.77. The increase in 1994 occurred as the number of major retailers purchasing fish increased above the level of one (a monopoly). Total ex-vessel revenue increased 51% in 1993. Inflation adjusted growth rates are similar.

2.4.2 Indicators

The average bottomfish catch per trip decreased slightly (11%) in 1994, compared to 1993. The average catch per trip is subject to significant biases (e.g., changes in trip length and relative amounts of bottomfishing compared to trolling). It may be possible to improve this measure of CPUE by using only those trips which landed bottomfish species exclusively. While such a calculation may be sensitive to other biases due to small sample size, it should be investigated in the future. This indicator does not suggest the need for any management action.

Even though bottomfish fishing effort and landings are increasing, the revenue obtained from bottomfish sales remains relatively stable in importance. The average revenue per bottomfish trip decreased slighltly (both for bottomfish totals and all species totals). Bottomfish fisherman often troll to and from the bottomfishing site, thus acquiring a mixed catch after spending the day "bottomfishing".

2.4.3 Recommendations

1) A full time staff person is needed to specifically monitor, assess and analyze bottomfish being landed, specifically those that are harvested from the Northern Islands.

2) Baseline (virgin stock) parameters (CPUE, percent immature) for the Guam/Northern Marianas deepwater bottomfish complex (e.g., survey on red-gilled emperor) need to be established utilizing data collected during Resource Assessment Investigation of the Marianas Archipelago (RAIOMA) cruises (1981-1984), to help calculate SPR, with assistance from NMFS.

2.5 Region-Wide Recommendations

1) The BPT is pleased with the continued improvements to the draft annual report modules made by the area representatives. The BPT recommends that: 1) further detail on the fishery be added to the introduction section of each area module, 2) confidence limits be included with major indicators, as appropriate, and 3) current WordPerfect graphics be considered by the area representatives for use as a module standard for the annual report.

2) The BPT recognizes that the American Samoa, Guam, and Northern Mariana Islands bottomfish fisheries are comprised of two separate species complexes (the shallower emperor based and deeper eteline/grouper based complexes). The BPT recommends that virgin population catch rates, size at maturity, percent immature, and SPR values be estimated for these complexes separately, and that NMFS Honolulu Laboratory staff develop methodology for the collection and analysis of appropriate data and provide it to the respective areas.

3) The NMFS review of overfishing definitions (by Rosenberg et al., 1994) found the Bottomfish FMP definition of SPR "misleading and ambiguous". Resolving the concerns may simply require clarifying the definition, with stronger reference to the cited paper by Somerton and Kobayashi. The BPT recommends that NMFS Honolulu Laboratory staff evaluate these concerns and respond as soon as possible.

4) The BPT concurs with the area specific recommendations (detailed below) presented in the 1994 annual report modules for American Samoa, Guam, Hawaii, and the Northern Mariana Islands. It specifically notes the importance of collecting virgin CPUE and size structure data that is available in the NMI and American Samoa. The BPT recommends that this data be collected now, in light of the current rapidly expanding NMI bottomfish industry, before the opportunity is lost.

Appendix 1

American Samoa

Introduction

Subsistence fishing from canoes (paopao) by the natives of the American Samoa islands has been a traditional practice in the distant past. But it was not until the early 1970s that the bottomfish fishery developed into a commercial venture utilizing motorized boats. A government subsidized program, called the Dory Project, was initiated in 1972 to develop the offshore fisheries into a commercial venture, and resulted in an abrupt increase in the fishing fleet and total landings. In 1982 a fisheries development project aimed at exporting high-priced deep water snappers to the Hawaii fish auction caused another notable increase in both bottomfish landings and revenue. Between 1982 and 1988, the bottomfish fishery comprised as much as 50% of the total commercial catch. Since 1988 the nature of American Samoa's fisheries has changed dramatically with a shift in importance from bottomfish fishing towards trolling.

During the early 1980s data were collected for the bottomfish fishery by interviewing only commercial vessels. In the current creel survey that started in October 1985, commercial, subsistence and recreational domestic boats landing catches in five designated areas were interviewed and their catches examined. For two weekdays and one weekend per week, DMWR data collectors sampled offshore fishermen between 0500 and 2100 hours. Two DMWR samplers based on the Manu'a islands collect fisheries data from the Tau, Ofu and Olosega fleet.

Boat-based fishing in Tutuila and Manu'a is mostly trolling and bottomfish fishing. The bottomfish fishery of American Samoa is typically commercial overnight jigging utilizing 28-foot aluminum catamarans (Alia). Fresh bottomfish imported mainly from the neighboring independent state of Western Samoa has assisted in satisfying the high demand for fresh fish that cannot be supplied by the small local commercial fleet. The adverse effects of three hurricanes that struck American Samoa in 1987, 1990 and 1991 can be seen in some of the trends in the fishery as depicted by the data in this report.

Summary

During 1994, a total of 21 local boats landed 39,500 pounds of bottomfish in the territory. Inflation-adjusted revenue for the domestic commercial fishery this year was estimated around $80,000, with all the catch being sold locally.

The fishery was relatively bigger between 1982 and 1986 than in recent years (Fig. 1). This observation reflects a trend in the loss of skilled and full-time fishermen from the fishery. Another important trend mirrored by the data is the shift of preference from bottomfish fishing to trolling, as the number of full-time commercial fishermen who could fish bottomfish overnight decreased. The December 1991 hurricane contributed to the 1992 decrease in landings (Fig. 1) and the second lowest number of trips ever recorded (Fig. 3). This year's significant increases in landings, trips, effort and subsequently revenues was a collective result of improved sampling on Tutuila, a 300% increase of the Manua landings, and increased efforts by the Tutuila highliners.

The CPUE (pounds per hour) in 1994 was 89% of the baseline CPUE, indicating no signs of stress in this fishery. The "estimate of the worst case" SPR (refer to the analysis in Fig. 7) indicated that recruitment overfishing is not occurring in this fishery. Currently available data do not indicate any serious problems with the stocks.

Recommendations

DMWR acted on the two recommendations in last year's report. The recommendations essentially were:

- To hire an additional sampler for the offshore (bottomfish) survey.
- To continue collecting samples for the SPR estimation project.

DMWR had hired an additional sampler and continued to collect samples for the SPR estimation project.

The collection of length/weight and maturity data that was recommended by the BPT continued this year. Insufficient samples, however, were obtained due mainly to the unavailablity of cash to buy fish samples and a prolonged period of unfavorable weather towards the end of the year. Preliminary analysis of the data collected so far has revealed several inconsistencies. It is therefore recommended that:

1) A biologist (instead of local technicians) be responsible for fish dissection and recording of data for this BPT-initiated project.
2) Cash for buying fish samples should be readily available.

3) This project should be continued and be made a high priority as the data obtained from it is crucial for the calculation of SPR.

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Table 1. American Samoa 1994 Estimated Total Bottomfish Landings

Species	Pounds
Redgill Emperor	1203
Ambon Emperor	3120
Longnose Emperor	2614
Emperors (misc)	3386
Tomato Grouper	556
Yellowspotted Grouper*	29
Peacock Grouper	401
Lyretail Grouper	1942
Spotted Grouper	159
Grouper (misc)	451
Bluelined Snapper	4015
Rufous Snapper	238
Stone's Snapper	268
Onespot Snapper	79
Yellowtail Kalekale	7
Black Snapper	230
Gindai	669
Jobfish	4285
Onaga	2780
Ehu	3028
Humpback Snapper	1774
Twinspot/red Snapper	953
Yelloweye Opakapaka	2720
Lehi	1523
Black Trevally	345
Bigeye Trevally	554
Jacks (misc)	2204
Total Bottomfish	**39533**
Total BMUS	**31679**

* Epinephelus sp.

Calculation: Catches are weighed by species either at landing sites or during the selling of fish to dealers. Analyses of American Samoa's bottomfish data are for the whole complex, not just for BMUS.

Interpretation: The appearance of new species in the past three years was due to the improved identification of various species by DMWR samplers. These species were occasionally present in landings from previous years, but were not identified at the species level.

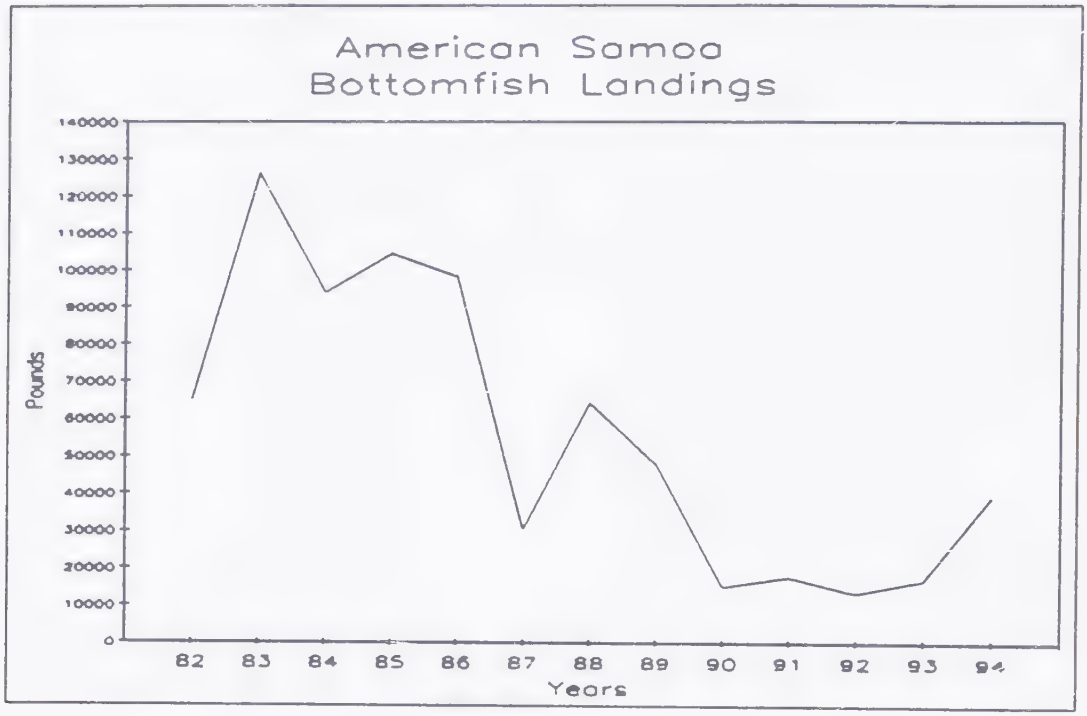
Table 2. American Samoa 1994 Estimated Average Price of Bottomfish Species

Species	Ave. Price ($/lb)
Redgill Emperor	2.00
Ambon Emperor	1.97
Longnose Emperor	1.93
Emperors (misc)	2.10
Tomato Grouper	1.78
Yellowspotted Grouper*	1.95
Peacock Grouper	2.00
Lunartail Grouper	1.88
Spotted Grouper	1.90
Grouper (misc)	1.90
Bluelined Snapper	2.00
Rufous Snapper	2.00
Stone's Snapper	2.06
Onespot Snapper	1.96
Yellowtail Kalekale	1.80
Black Snapper	2.03
Gindai	2.00
Jobfish	1.93
Onaga	2.08
Ehu	2.27
Humpback Snapper	1.98
Twinspot/red Snapper	1.90
Yelloweye Opakapaka	2.47
Lehi	2.23
Black Trevally	2.08
Bigeye Trevally	1.95
Jacks (misc)	1.71
Total Bottomfish	**2.03**
Total BMUS	**2.05**

Calculation: During creel surveys, the disposition of the catch is recorded, and if sold, the price is obtained whenever possible. The average prices reported in this table are calculated by dividing the total revenue by the weight sold in pounds for each species.

Interpretation: There appears to be no significant changes in the prices of individual species in the past five years. DMWR keeps track of imported bottomfish through a separate Commercial Invoice System. Data from that system reveals that since 1992, the average prices of bottomfish imported from Western Samoa were lower than for locally-caught bottomfish. There was only one 400-pound shipment from Tonga this year and it was sold at $1.70/lb.

Figure 1. American Samoa bottomfish landings



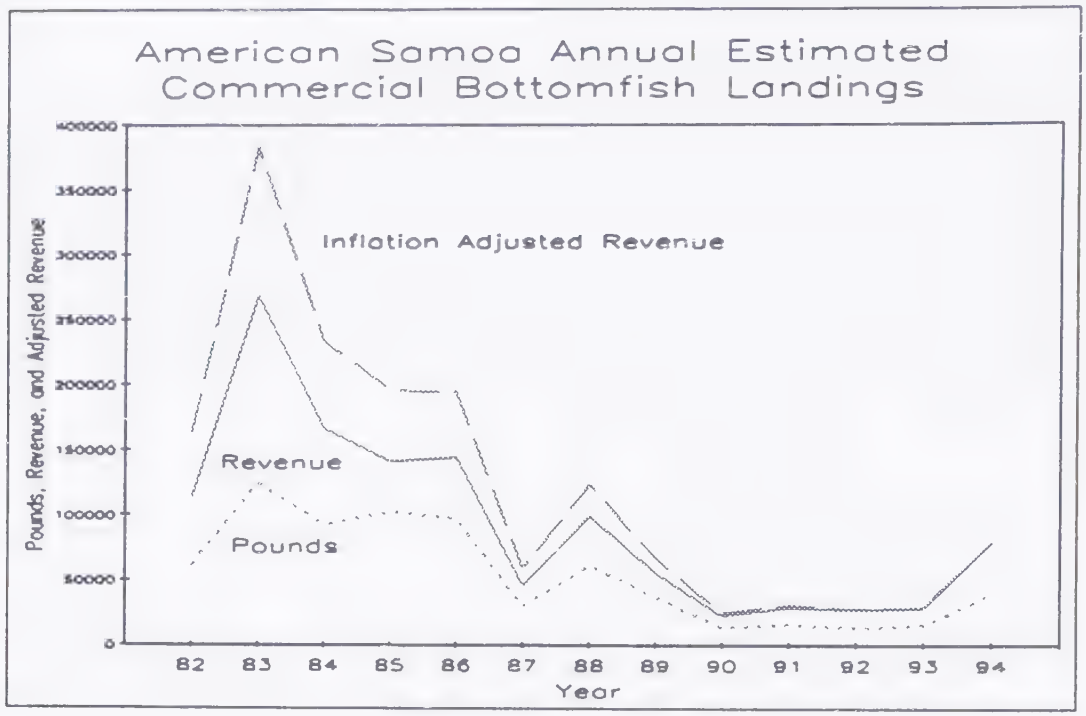
Year	Landings (lb)
1982	64,942
1983	126,327
1984	94,104
1985	104,675
1986	98,361
1987	30,640
1988	64,530
1989	48,137
1990	15,445
1991	17,917
1992	13,715
1993	17,098
1994	39,533

Calculation: Bottomfish landings for 1982-84 are calculated by adjusting the sampled Tutuila data by the calculated annual percent coverage of the fleet, and then adding the similarly adjusted Manu'a landings. The 1986-present landings are from the creel survey expanded species composition files (*.SPC) which contain the annual estimated total landings by species

for Tutuila, and then adding the adjusted Manu'a landings. Calculating statistics for 1985 is more complicated because the sampling program changed from commercial fleet sampling only to creel sampling on October 1, 1985.

Interpretation: The substantial declines in landings in 1987 and 1990 were partially due to vessel losses caused by two hurricanes. Boat repairs were delayed as fishermen repaired or rebuilt their houses. In terms of total landings, the bottomfish fishery is much smaller in recent years than it was any time between 1982 and 1986, a period when there was a relatively large fleet and fishermen were attracted to the then profitable bottomfish export program. The significant increase this year was due primarily to improved sampling on Tutuila and increased efforts by the Tutuila highliners. Furthermore, the Manua landings more than tripled this year due to increased efforts to obtain each chief's (matai) required fish apportionment for several governmental and cultural events.

Figure 2. American Samoa annual estimated commercial bottomfish landings.



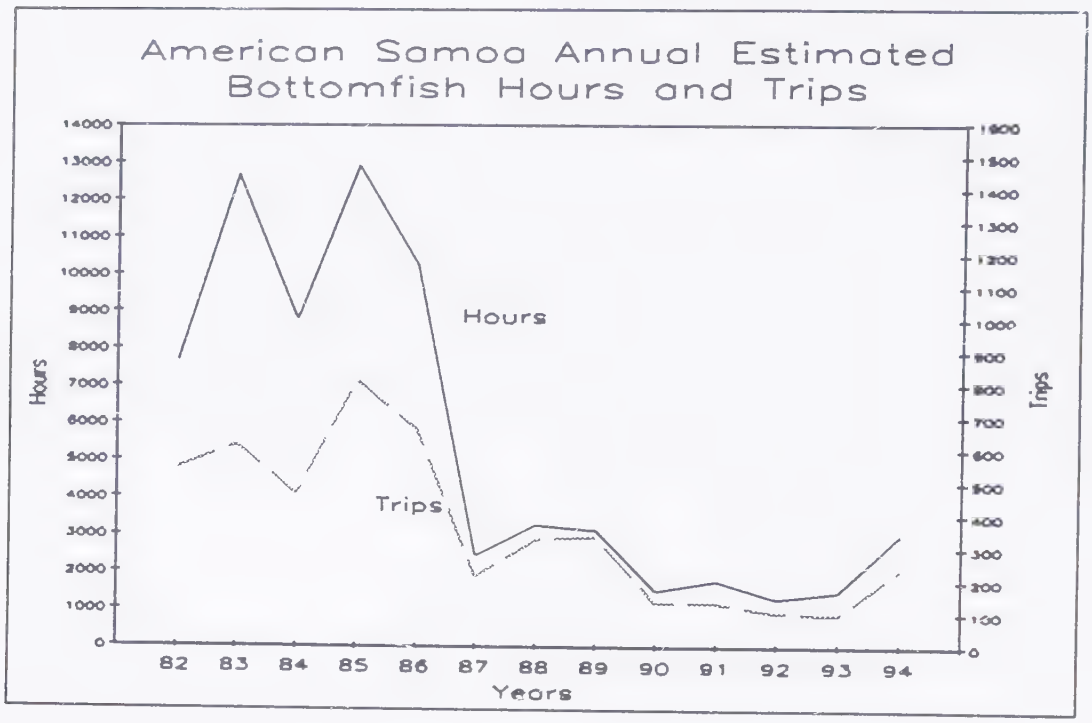
Year	Commercial Landings	Revenues	Inflation-Adjusted Revenues
1982	62,016	113,678	163,469
1983	125,167	269,083	383,981
1984	92,841	166,917	233,684
1985	102,670	141,495	196,253
1986	97,540	144,742	194,388
1987	30,236	46,537	59,846
1988	61,897	99,482	124,054
1989	37,438	56,433	67,437
1990	13,992	23,161	25,709
1991	16,296	29,439	31,294
1992	13,663	27,450	28,026
1993	16,146	29,160	29,714
1994	39,126	79,536	79,536

Calculation: A relatively complex set of algorithms are used to estimate the commercial landings from estimates of total landings created by the creel survey data expansion system. In short, the percent sold by fishing method is calculated monthly and multiplied by the percent species composition by month, then multiplied by the estimated total landings for that method

and month. For 1982-85 sampling was conducted on the commercial fleet only (which included nearly all the fishing boats), whereas since 1985 creel sampling has covered all boats (commercial and recreational). Analysis of creel data for 1986-87 indicates that over 98% of the landed bottomfish were being sold. Therefore, it is believed to be valid to compare commercial data for years prior to 1986 to creel survey totals for years since 1986.

Interpretation: Commercial landings mirror the total fishery's declining catches in recent years. Relative to total landings, commercial landings decreased even more substantially in 1989, because the percent of the catch sold by bottomfish fishermen dropped from an average of about 97% in 1982-88 to 78% in 1989. The peak in 1983 portrays the high prices of deep water snappers exported to Hawaii, while the trough in 1987 can be attributed to effects of the 1987 hurricane. The December 1991 hurricane contributed largely to the decreased landings and subsequently a decrease in revenues in 1992. Unfavorable weather continued through May 1992 hindering commercial bottomfish trips. Increased efforts this year produced a notable increase in revenues.

Figure 3. American Samoa annual estimated bottomfish hours and trips



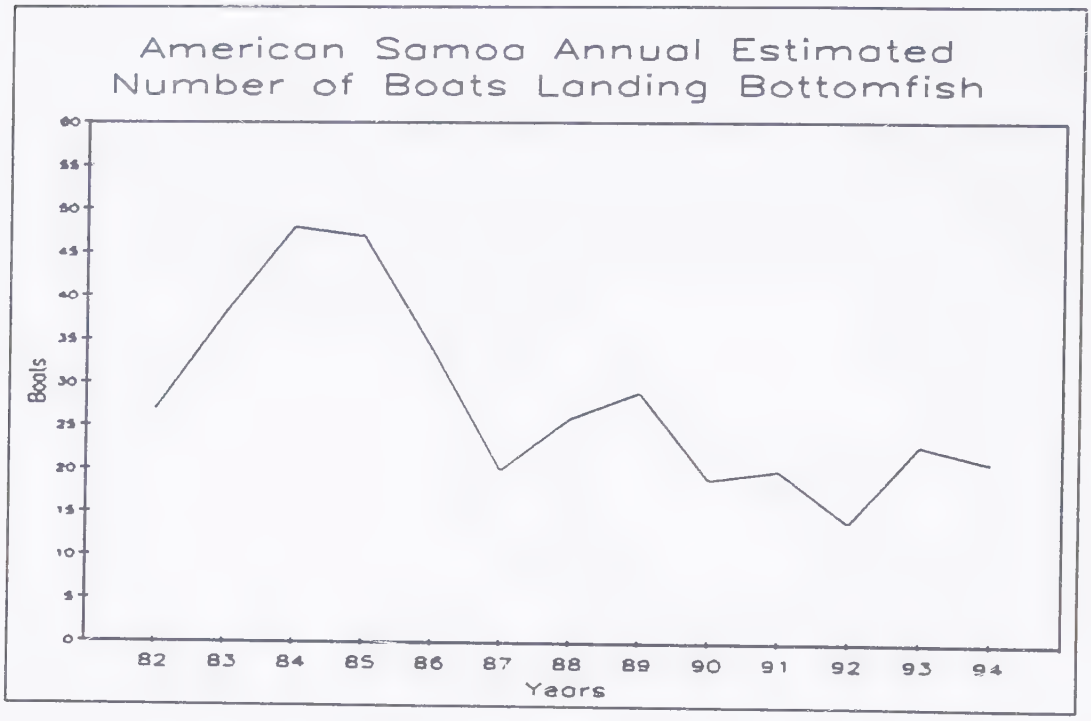
Year	Hours	Trips
1982	7,671	548
1983	12,695	621
1984	8,796	468
1985	12,933	816
1986	10,255	666
1987	2,458	217
1988	3,281	330
1989	3,141	340
1990	1,514	136
1991	1,797	136
1992	1,312	107
1993	1,494	100
1994	3,017	238

Calculation: The annual estimated effort (hours) spent bottomfish fishing is calculated by dividing the annual estimated total bottomfish catch by the average CPUE (pounds per hour) from trips doing only bottomfish fishing. The annual estimated number of trips is calculated by dividing the estimated annual hours by the average length of a bottomfish fishing trip. The average length of a bottomfish fishing trip (not shown) is calculated by using only trips which

exclusively bottomfished and for which the trip length was recorded. The total hours fished from those trips is then divided by the number of trips. Recorded hours are trip hours.

Interpretation: The sharp decline in the bottomfish landings since 1986, noted in Fig. 1 is mirrored in this figure by a sharp decline in the level of effort expended in that fishery. Rather than indicating a problem with the resource, this decline depicts an actual trend of commercial boat owners and fishermen seeking other more lucrative and stable lines of work. The noticeable increase in effort this year is primarily due to improved sampling, increase effort by the Tutuila highliners and the significant (about tripled) increase in effort by the Manua fleet.

Figure 4. American Samoa annual estimated number of boats landing bottomfish

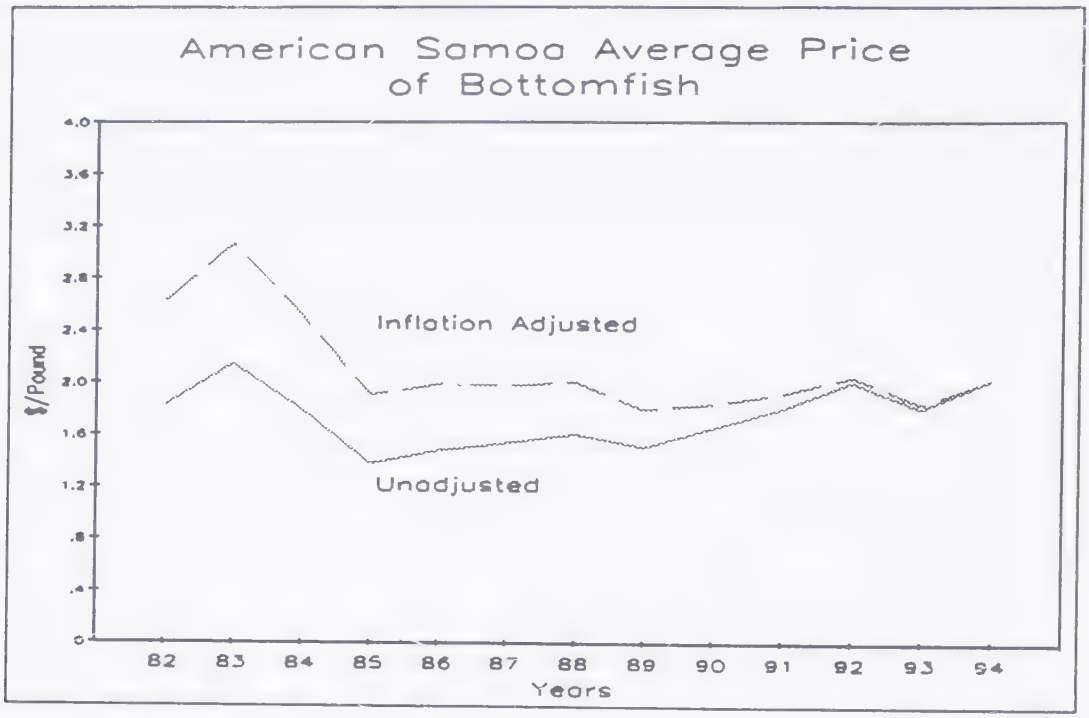


Year	Boats
1982	27
1983	38
1984	48
1985	47
1986	34
1987	20
1988	26
1989	29
1990	19
1991	20
1992	14
1993	23
1994	21

Calculation: The annual estimate of the number of boats in the bottomfish fishery is obtained from the data base by counting the unique boats sampled during the year which landed any bottomfish species.

Interpretation: Again, the decline in the fishery since 1985-86 is noted by a decline in the number of boats participating in it. The 1987 hurricane caused the loss of the whole Manu'a fleet, plus some of the Tutuila fleet. Several boats which contributed to the 1989 bottomfish annual landings did not land any bottomfish in 1990, due to much needed repairs and their participation in non-bottomfish chartered trips. About 90% of the domestic fishing fleet was affected by the December 1991 hurricane, hence the decline in 1992. The increase since then is due mainly to the re-entry to the fishery of a few vessels after repairs, trips by two 14-foot vessels that did not bottomfish in 1992, and the entry of one new alia into the sampling area.

Figure 5. American Samoa average price of bottomfish

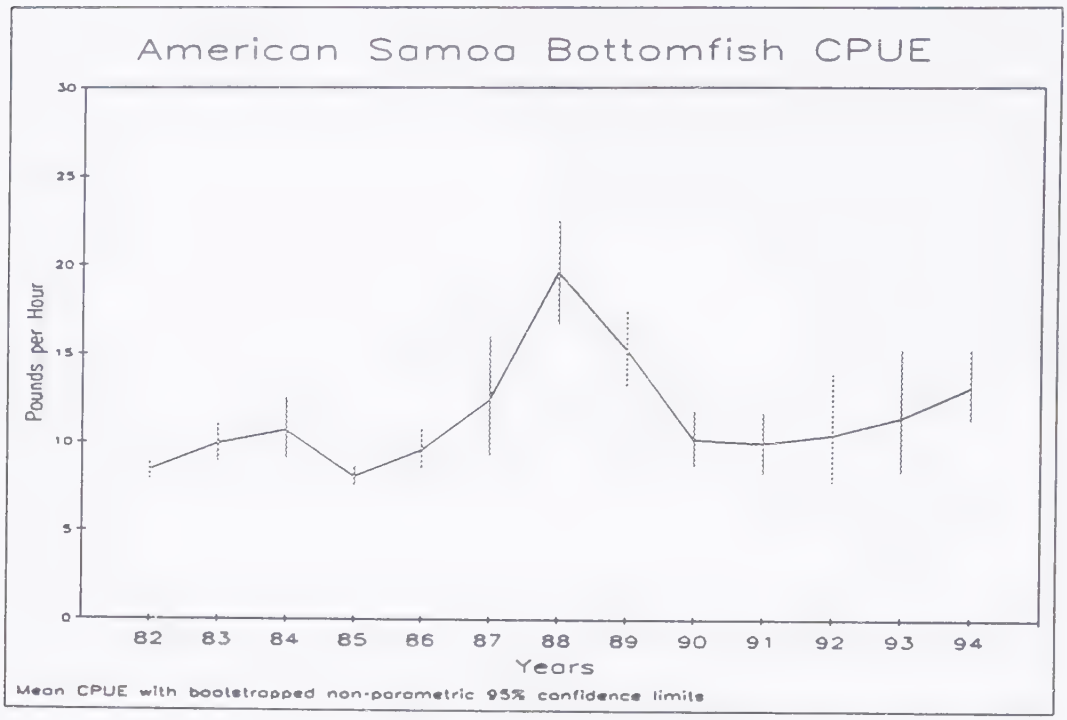


Year	$/lb	Inflation-Adjusted $/lb
1982	1.83	2.63
1983	2.15	3.07
1984	1.80	2.52
1985	1.38	1.91
1986	1.48	1.99
1987	1.54	1.98
1988	1.61	2.01
1989	1.51	1.80
1990	1.66	1.84
1991	1.81	1.92
1992	2.01	2.05
1993	1.81	1.84
1994	2.03	2.03

Calculation: The average price of all bottomfish species combined is calculated by dividing total bottomfish revenue by total sold weight. The inflation adjusted price is calculated by multiplying the unadjusted annual average price by the annually calculated consumer price index (CPI) for American Samoa using the current year as the base. The 1994 CPI was 143.8.

Interpretation: Prices were generally higher between 1982 and 1984 during the exportation of high-priced deepwater snappers to Hawaii. After this period, inflation-adjusted local prices have generally been stable. Prices of locally-caught bottomfish are generally higher than imported fish, and could have been even higher had the local markets not been flooded by imported fish, which are generally of lower quality.

Figure 6. American Samoa annual bottomfish CPUE

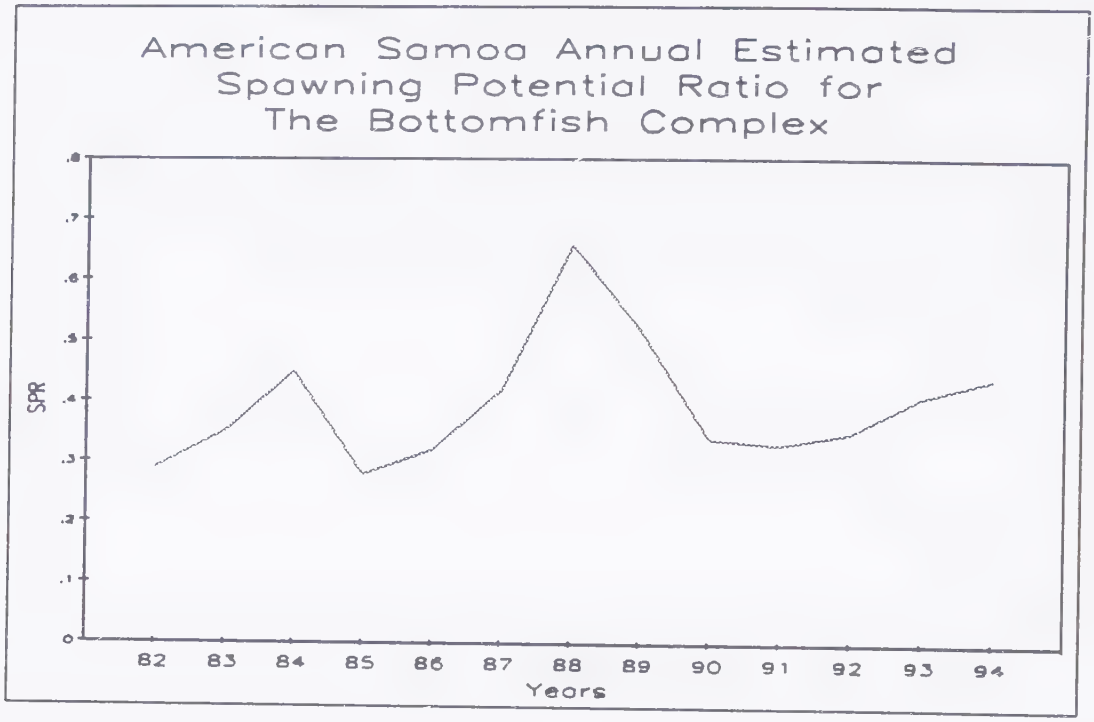


Year	CPUE
1982	8.5
1983	10.0
1984	10.7
1985	8.1
1986	9.6
1987	12.5
1988	19.7
1989	15.3
1990	10.2
1991	10.0
1992	10.5
1993	11.4
1994	13.1

Calculation: CPUE (pounds per hour) is calculated using only trips in which only bottomfish method was used and trip hours was recorded. The average is calculated by using each CPUE from each trip as an observation and dividing by the number of trips.

Interpretation: The initial high CPUE in 1983 and 1984 occurred during the intense fishing of some new fishing grounds for deepwater snappers exported to the more lucrative Hawaii auction. A relatively high number of boats and local commercial fishermen participated in the fishery during this period. The drop in 1985 and 1986 might be expected following the ardent harvesting of the limited fishing grounds. Reasons for the CPUE peak in 1988-89 are unknown. The decline in CPUE from 1989 to 1991 can be partially attributed to a combination of some new, inexperienced fishermen entering the fishery and the exit of experienced and full-time commercial fishermen. CPUE has essentially remained stable during 1990 to 1992, and has increased since then. This year's CPUE is 89% of the "estimated virgin baseline CPUE", indicating no signs of stress in this fishery.

Figure 7. American Samoa annual estimated spawning potential ratio for bottomfish complex



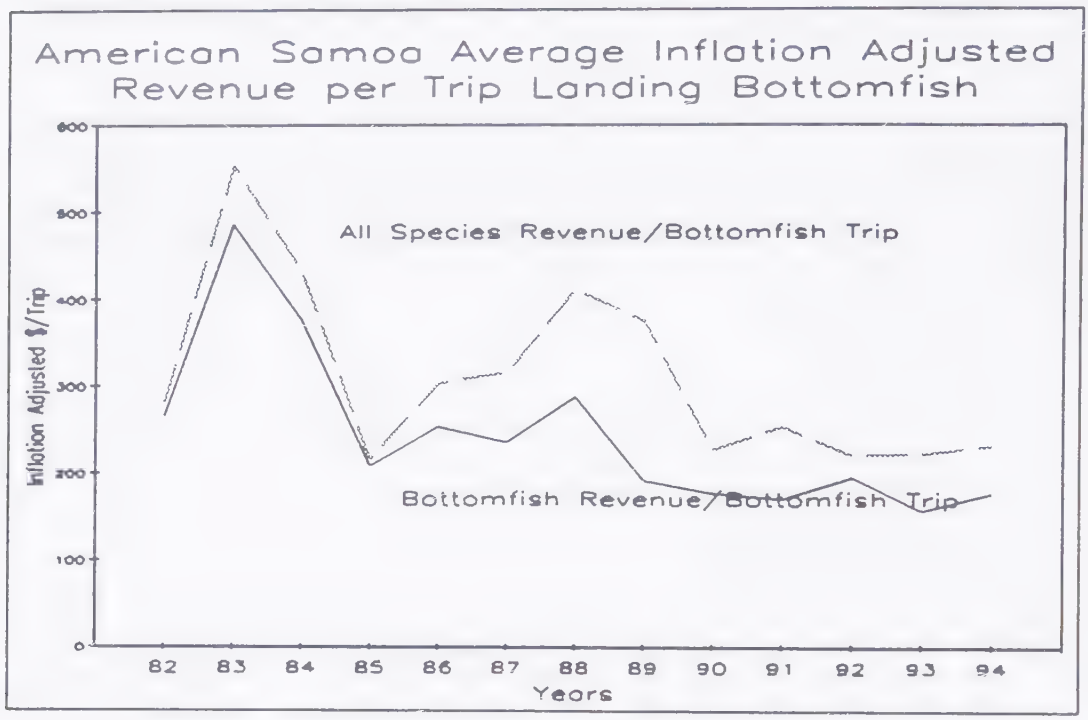
Year	SPR
1982	0.29
1983	0.35
1984	0.45
1985	0.28
1986	0.32
1987	0.42
1988	0.66
1989	0.52
1990	0.34
1991	0.33
1992	0.35
1993	0.41
1994	0.44

Calculation: The spawning potential ratio is calculated by dividing the current year's CPUE by the virgin population CPUE, and then multiplying by the ratio of the current percent mature to the virgin population percent mature fish in the catch. To estimate SPR for American Samoa, the "Dory" project mean CPUE (refer to 1990 annual report page 20, Table 3) was used to estimate virgin population CPUE (14.8 lb/hr). Since size and maturity data available

for bottomfish in American Samoa are insufficient, the ratio of percent mature in the catch was estimated by substituting the average of the 5 species which have the lowest SPR in Hawaii (in 1991). In this manner a "worst case" SPR was calculated to provide what should be a very conservative estimate of SPR for the American Samoa bottomfish complex.

Interpretation: The proxy "worst case" SPR for 1994 was 0.44, substantially above the 0.20 critical level. According to this indicator, the bottomfish complex of American Samoa is not considered to be recruitment overfished. Since the current estimation of American Samoa's SPR has continuously used the same size and maturity data from the Hawaii fishery [refer to above **Calculations**], this year's SPR subsequently increased with this year's increase in CPUE.

Figure 8. American Samoa average inflation-adjusted revenue per trip landing bottomfish



	Bottomfish $/Trip		All Species $/Trip	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted
1982	185	266	196	281
1983	341	487	388	554
1984	269	376	309	433
1985	151	209	157	217
1986	189	254	226	304
1987	184	236	246	316
1988	231	288	331	412
1989	162	193	315	377
1990	161	178	205	228
1991	161	171	240	256
1992	192	196	217	222
1993	155	158	218	222
1994	178	178	233	233

Calculation: The average revenue per trip for all species is calculated by summing the revenue of all sales for any trip which landed any bottomfish species, and dividing by the

number of trips. The average bottomfish revenue per trip is calculated from those same trips by summing the sales of only bottomfish species and dividing by the number of trips. Figure 8 plots the inflation adjusted bottomfish and all species revenues per trip for the period 1982-94.

Interpretation: The distance between these two lines reflects the relative importance of bottomfish species in the total catch whenever any bottomfish are landed. The prominent importance of bottomfish between 1982 and 1985 occurred during the targeting of deepwater snappers for export. Bottomfish fishing was also the more profitable method of fishing during that period. The relative importance of bottomfish has generally been declining since 1985 as most of the full-time commercial fishermen quit the fisheries. The supply of locally caught bottomfish has been supplemented by the significant quantity of imported bottomfish. The slight increase this year doesn't promise future increase in participation since cheaper imported bottomfish continuously flood the local markets.

Appendix 2

Guam

Introduction

Guam has two distinct bottomfish fisheries which can be separated by depth and species. The shallow-water complex (100-500 feet) makes up a larger portion of the total bottomfish harvest and is comprised of an assemblage of reef-dwelling snappers, groupers and jacks of the genera *Lutjanus, Lethrinus, Aprion, Epinephelus, Variola, Cephalopholis* and *Caranx.* The deepwater complex (500-700 feet) consists primarily of snappers and groupers of the genera *Pristipomoides, Etelis, Aphareus, Epinephelus,* and *Cephalopholis.*

Bottomfishing on Guam is a highly seasonal combination small-scale commercial and subsistence fishery. The majority of the participants are part-time recreational and subsistence fishermen who operate vessels less than 25 feet in length, primarily target the shallow-water bottomfish complex, combine some trolling effort to supplement bottomfishing effort, and seldom sell their catch commercially. Historically, notable increases and declines in Guam's total annual bottomfish harvests have been caused by the respective entry and exit of highliner vessels. These highliner vessels tend to be greater than 25 feet in length and their effort is usually concentrated on the deepwater bottomfish complex. Bottomfishing effort for both recreational fishermen and highliners is highest during the summer months when sea conditions are generally much calmer.

Centrally located on the western leeward coast, the Agana Boat Basin serves as the island's primary small-boat launch site to fishing areas off the central and northern leeward coast as well as the northern banks. Situated to the south, the Merizo Pier, Umatac Boat Ramp and Agat Marina serve as access points to the southern shores and banks. The Agat Marina in particular, strategically located between the Agana Boat Basin and the Merizo Pier, provides boats trailered from the northern and central portions of the island a closer and more convenient launch site to the southern fishing grounds. Plans to construct three additional boat ramps at presently undeveloped eastern windward launch sites are currently being considered. If completed, the new boat launches are expected to significantly increase bottomfishing effort on the eastern side of the island.

The demand for both deep-water and shallow-water bottomfish continues to exceed the locally caught supply. Guam's deep-water bottomfish fishery, especially during the absence of highliner vessels, has limited economic importance. The cultural value of its shallow-water complex however, remains high due to the local popularity of this assemblage of fish as food items. Some of the demand for both complexes of bottomfish is offset with imports from other islands throughout Micronesia. The quality, competitive pricing and consistent availability of imported fish has had the effect of discouraging local attempts to supplant foreign catches with Guam caught fish.

The Bottomfish Management Unit Species (BMUS) are: *Aphareus rutilans*, *Aprion virescens*, *Caranx ignobilis*, *Caranx lugubris*, *Cephalopholis urodeta*, *Epinephelus fasciatus*, *Etelis carbunculus*, *Etelis coruscans*, *Lethrinus amboinensis*, *Lethrinus rubrioperculatus*, *Lutjanus kasmira*, *Pristipomoides auricilla*, *Pristipomoides filamentosus*, *Pristipomoides flavipinnis*, *Pristipomoides seiboldi*, *Pristipomoides zonatus*, *Seriola dumerili* and *Variola louti*. For Table 1, *Epinephelus fasciatus* and *Variola louti* comprise the grouper category; *Caranx ignobilis* and *Caranx lugubris* comprise the jack category; and *Lethrinus amboinensis* and *Lethrinus rubrioperculatus* comprise the emperor category.

Summary

Although normal survey expansion algorithms are still being used to process Guam's fishery data in a spreadsheet format, the estimates produced and presented in the 1994 annual report do not include statistics of confidence or biological data, such as mean species lengths. Species composition is limited to BMUS and a few other species of major importance. To assist in correcting these data deficiencies, efforts are currently being made by the Division of Aquatic and Wildlife Resources (DAWR) to finalize a contract to develop a state-of-the-art database computer program (in 4th Dimension for Macintosh) that will analyze the results of the Guam Offshore Fisheries Expansion System. The software to be developed will provide DAWR with the capability of integrating the offshore survey expansion data with the inshore survey expansion data, and additionally produce statistics of confidence, a compilation of biological data, and a complete species composition analysis. Furthermore, DAWR intends to purchase additional computer hardware that will facilitate production of annual reports utilizing standardized word processing, spreadsheet and graphics software (i.e., WordPerfect 6.1 for Windows).

Analysis of the Guam deepwater bottomfish fishery does not show any problems through review of Fishery Management Plan descriptors or indicators. This is due in large part to the predominance of part-time recreational and subsistence fishermen in this fishery and moderate levels of highliner effort. Furthermore, seasonal weather patterns generally limit fishing opportunities to the summer months when seas are usually calmest. The data collected and Plan Team indicators analyzed for Guam's bottomfish fishery once again show no need for management action.

Due to a staff shortage, no progress was made on the 1993 Annual Bottomfish Report recommendations to conduct a study of the red-gilled emperor and calculate the SPR for Guam.

Recommendations

1) Recognizing that the 1991 through 1994 annual reports are not completely representative of the data analysis required for the annual reports, and that this deficiency continues to jeopardize confidence in the data presented in the Guam reports, an effort to rectify this shortcoming should be pursued quickly and the analysis of the available data eventually be repeated by computerized expansion. Finalization of the contract to develop a customized computer program that will adequately process the data should be completed by the end of CY 1995.

2) The need to complete a baseline biological survey of the red-gilled emperor (*Lethrinus rubrioperculatus*) remains as the single most important data deficiency for the Marianas shallow water bottomfish resource. Thus, the previous recommendations in the 1992 and 1993 Guam annual reports to establish a joint program with the CNMI continues to be a priority; especially in light of the fact that the window of opportunity to conduct such a project with the CNMI's virgin stocks is rapidly closing as commercial bottomfishing operations continue to grow in number and increase their fishing effort.

3) With the assistance of the National Marine Fisheries Service, calculate the spawning potential ratio (SPR) for Guam's deep *and* shallow water bottomfish complexes.

4) Further investigate reports of local highliners fishing in CNMI waters but landing their CNMI-caught fish on Guam. Based on two interviews that were obtained in 1994, the survey expansion resulted in an estimate of 11 trips and 10,413 pounds of bottomfish, approximately 13% of Guam's total bottomfish landings, being caught in CNMI waters by Guam-based fishermen but landed on Guam.

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Table 1. Guam 1994 creel survey composition of bottomfish management unit species (BMUS)

Species	All Methods (lbs)	Bottomfishing Only (lbs)
Grouper	2902	2902
Jacks	3363	3348
Lehi	5277	5277
Uku	1770	1770
Ehu	3704	3704
Onaga	2983	2983
Taape	1203	1084
Yellowtail Kalekale	8233	8233
Opakapaka	1458	1458
Yelloweye Opakapaka	3542	3542
Kalekale	546	546
Gindai	4428	4428
Emperor	7274	7274
Amberjack	2486	2486
Total	**49169**	**49035**

Figure 1. Guam Harvest of BMUS and all bottomfish

Year	Total Bottomfish Harvest (lbs)	Total BMUS Harvest (lbs)	BMUS Harvest by Bottomfishing (lbs)
1980	37,399	19,253	19,145
1981	63,654	42,517	42,443
1982	63,442	43,428	42,678
1983	53,404	39,193	39,193
1984	56,998	32,232	32,089
1985	94,318	68,141	65,941
1986	30,368	17,969	17,069
1987	35,033	24,288	23,828
1988	52,791	33,724	32,750
1989	53,272	39,814	38,689
1990	45,374	31,295	30,515
1991	51,329	29,962	28,289
1992	50,099	34,057	31,745
1993	78,355	48,494	47,657
1994	83,367	49,169	49,035

Source: The DAWR offshore creel survey data as expanded by computer-based algorithms by method of fishing. All unidentified catch was allocated to species categories based on the species percentage of the total catch.

Calculations: The estimated total landings of the bottomfish species are selected from the creel survey expanded species composition files. However, the expanded estimates of catch by species must include at least a portion of the catch identified only by generic species codes categories. These generic categories (e.g. "mixed shallow bottomfish") also include some non-bottomfish species according to the FMP definition (e.g. squirrelfish).

Interpretations: Fluctuations in the bottomfish landings on Guam are due primarily to an increase or decrease in the number of boats entering or leaving the fishery, particularly highliners. The 64% average increase in total and commercial BMUS landings in 1993-94 over the preceding years in 1991-92 is mirrored by a similar 64% average increase in the number of boats participating in bottomfishing during the same periods (see Figure 4). Additionally, whereas there was an estimated 3-4 highliner vessels working the waters around Guam in 1993, there is was an estimated 6-8 highliners engaged in bottomfishing during 1994. The 1985 peak and apparent crash in 1986 were largely due to a few highliner fishermen who fished in 1985, but not in 1986.

What effect the opening of the Agat Marina in 1989 has had on Guam's bottomfish landings estimates has yet to be determined, since a creel survey for this access point was not established until 1 October 1994. Although boat trailer counts have been recorded for this facility, the ratio of bottomfish participants to other methods has not yet been calculated.

Table 2. Guam 1994 commercial bottomfish average price

Species	Average $/lb
Bottomfish	3.60
Grouper	2.01
Jacks	2.04
Lehi	4.11
Uku	2.16
Ehu	3.90
Onaga	4.90
Opakapaka	3.87
Kalekale	3.57
Gindai	4.02
Emperor	2.61
All Bottomfish Species	**3.47**

Note: The source of this information is different than the values presented for harvest and therefore the species covered may vary slightly between data bases.

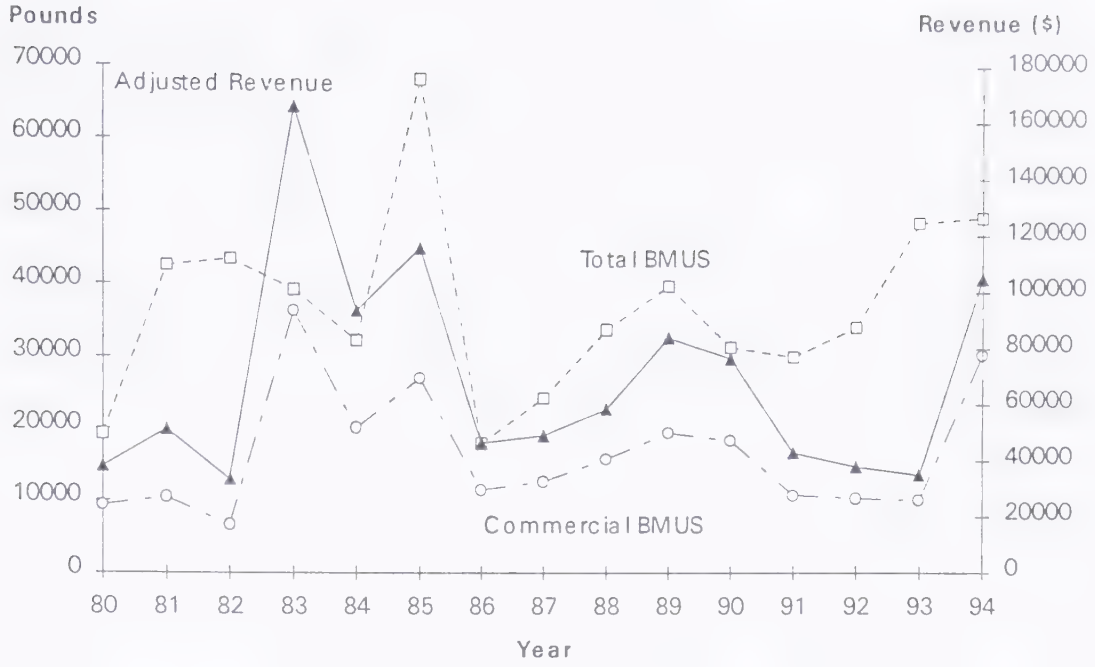

Figure 2. Total and commercial BMUS harvest, and revenue

Year	Total BMUS Harvest (lbs)	Commercial BMUS Harvest (lbs)	Unadjusted Revenue ($)	Inflation-Adjusted Revenue ($)
1980	19,253	9,381	11,458	37,893
1981	42,517	10,459	18,590	51,048
1982	43,428	6,617	12,753	33,311
1983	39,193	36,281	65,543	165,430
1984	32,232	20,115	40,176	93,289
1985	68,141	27,064	51,777	115,721
1986	17,969	11,482	21,289	46,324
1987	24,288	12,639	23,551	49,081
1988	33,724	15,792	29,568	58,545
1989	39,814	19,442	47,029	83,993
1990	31,295	18,390	48,983	76,561
1991	29,962	10,773	30,234	42,871
1992	34,057	10,334	29,410	37,881
1993	48,494	10,125	29,348	34,895
1994	49,169	30,237	104,827	104,827

Source: The estimated total landings are from the DAWR creel survey system, and the commercial data are from the WPACFIN-originated commercial landings system.

Calculations: The total commercial bottomfish landings and revenue for each year were calculated by summing the weight and value fields in the commercial landings data base and

then multiplying by an estimated percent coverage expansion factor. This annual expansion factor was subjectively created and includes an analysis of the "disposition of catch" data available from the DAWR offshore creel survey, an evaluation of the fishermen in the fishery and their entry/exit patterns, general "dock-side" knowledge of the fishery, status of marketing conditions and its structure, overall number of records in the data base, and a measure of the best-educated guess.

Interpretations: The nearly three-fold increase in the commercial BMUS landings and revenue is largely the result of additional highliner vessels entering (or reentering) into the fishery. Whereas there was an estimated 3-4 highliners working Guam's waters in 1993, the number is estimated to have doubled in 1994 to between 6-8 highliners.

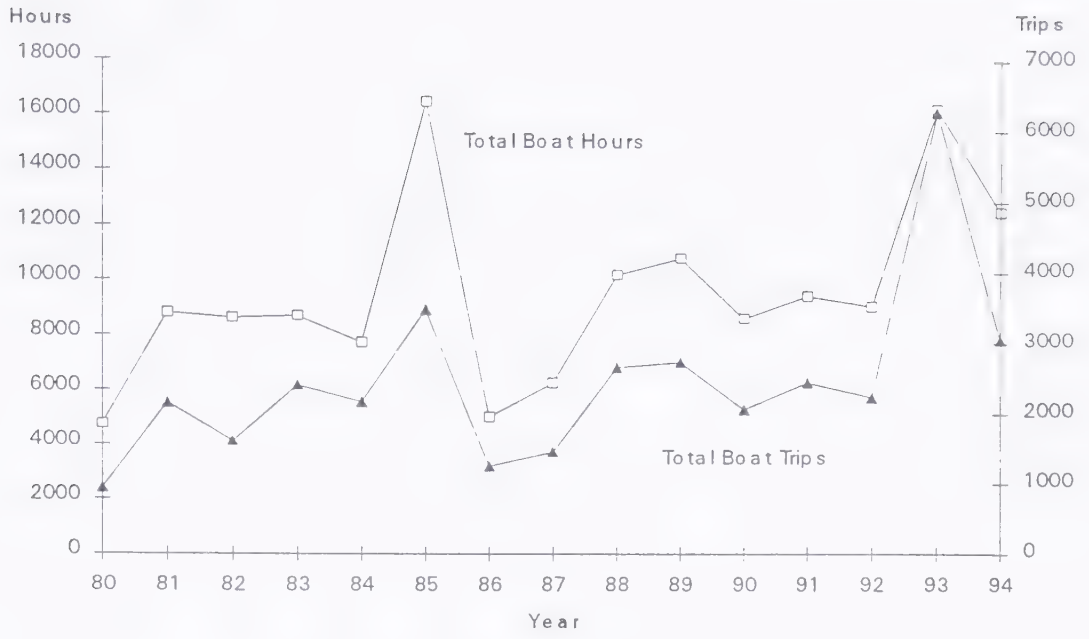

Figure 3. Estimated boat hours and trips

Year	Total Boat Hours	Total Boat Trips
1980	4,752	929
1981	8,804	2,150
1982	8,621	1,606
1983	8,699	2,401
1984	7,730	2,160
1985	16,477	3,471
1986	5,018	1,246
1987	6,264	1,447
1988	10,208	2,653
1989	10,818	2,732
1990	8,628	2,060
1991	9,440	2,444
1992	9,072	2,234
1993	16,238	6,265
1994	12,512	3,056

Source: The DAWR creel survey data for bottomfishing methods.

Calculations: The estimated number of boat trips and boat hours for bottomfishing methods are derived directly from the creel survey expansion algorithms.

Interpretations: In 1994 there was a 51% reduction in the total number of boat trips and a concomitant 23% drop in the total number of boat hours from the previous year's totals, despite a 1% increase in total BMUS landings and a dramatic three-fold increase in

commercial BMUS catch for the same year (see Figure 2). Contributing to the 1994 declines was the extended period of unusually calm seas in late 1993 which resulted in an exceptionally high number of boats participating in bottomfishing that year. Thus, the 1994 "declines" are somewhat misleading and are actually considered to be more representative of an expected average annual *increase* in the total number of boat trips and boat hours since 1986. The succession of typhoons and inclement weather that hit Guam between 1990 and 1992 suppressed the continued trend of a steady and slight increase in the number of boat trips and boat hours from 1986 to 1994. The appearance of additional highliners into the 1994 fishery best explains the three-fold increase in 1994 commercial BMUS landings.

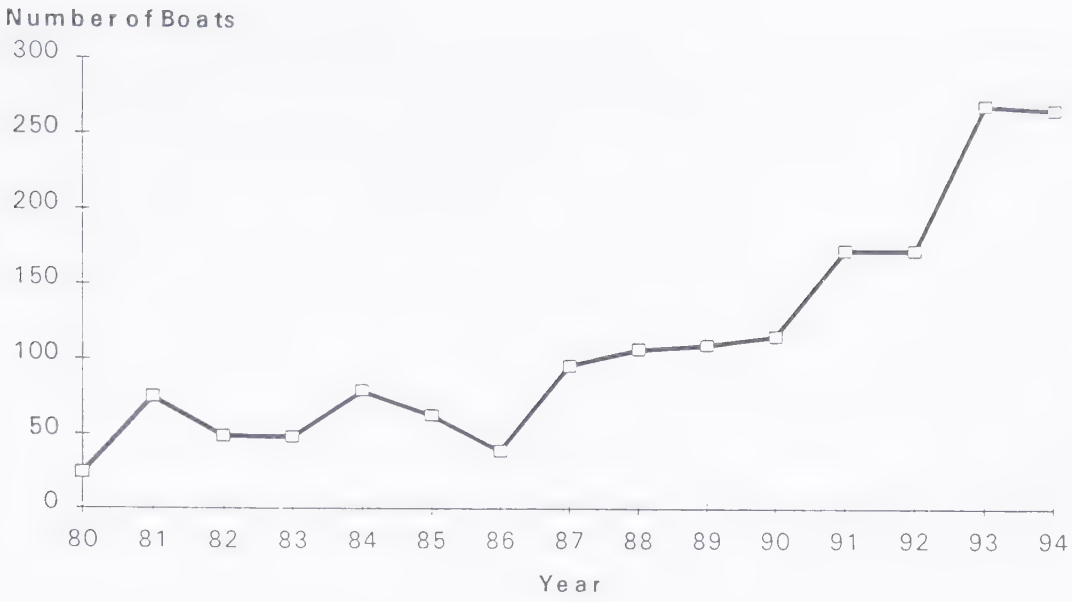

Figure 4. Guam bottomfish fishery participation

Year	Number of Boats
1980	24
1981	75
1982	49
1983	48
1984	79
1985	63
1986	39
1987	96
1988	107
1989	110
1990	116
1991	173
1992	173
1993	271
1994	268

Source: DAWR offshore creel survey data from Agana Boat Basin

Calculations: The median estimated number of boats should be considered as conservative estimates because boats which use unsurveyed launch sites will never be encountered and because surveys are conducted on only 13% of the possible days.

Interpretations: Over the last several years the number of boats participating in this fishery has increased steadily. The approximately 57% increase between 1992 and 1994 is believed to be the result of an increase in the sampling effort with the inclusion of the Merizo Pier as a

survey site since 1991, a healthy economy that has made it possible for more residents to afford boats, and a return of fair weather that allowed for more favorable fishing conditions. The establishment of a creel survey at the Agat Marina in October 1994 is expected to further increase the accuracy of the estimated number of boats participating in the fishery.

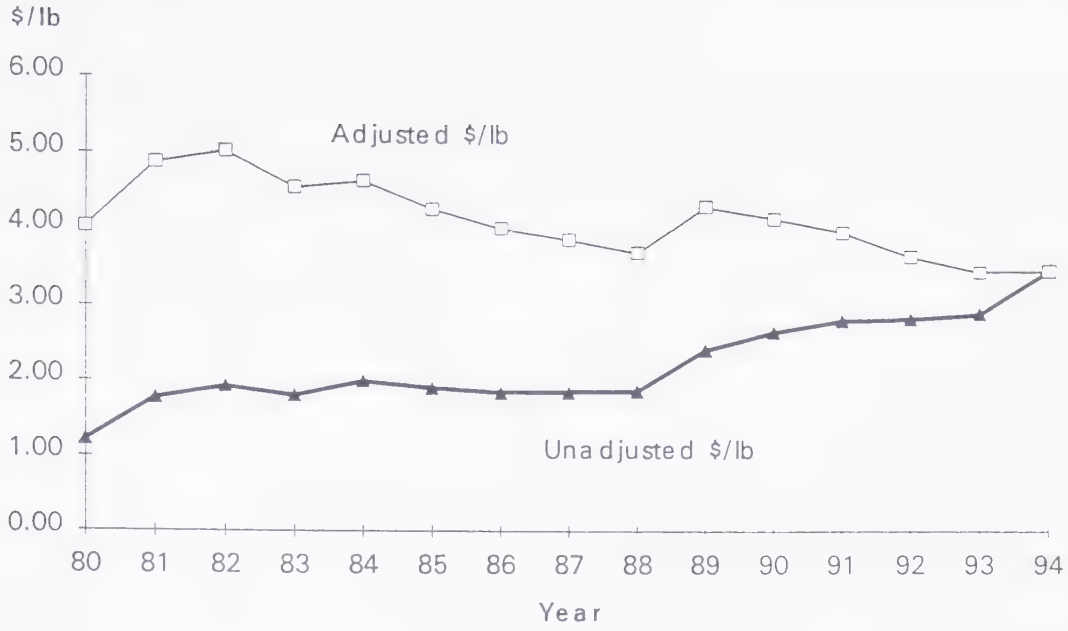

Figure 5. Average bottomfish prices

Year	Unadjusted $/lb	Adjusted $/lb
1980	1.22	4.04
1981	1.78	4.88
1982	1.93	5.03
1983	1.81	4.56
1984	2.00	4.64
1985	1.91	4.28
1986	1.85	4.03
1987	1.86	3.88
1988	1.87	3.71
1989	2.42	4.32
1990	2.66	4.16
1991	2.81	3.98
1992	2.84	3.66
1993	2.90	3.45
1994	3.47	3.47

Source: The commercial landings data from the major wholesaler.

Calculations: The average price of all bottomfish species combined is calculated by dividing the total bottomfish revenue by the sold weight. The inflation adjustment is made by using the Consumer Price Index (CPI) for Guam and establishing the 1994 figure as the base to calculate all

previous years (i.e. divide the 1994 CPI by the CPI for any given year), and then multiplying the unadjusted average price by this factor to obtain the adjusted average price for the given year.

Interpretations: The adjusted average price for bottomfish has not shown consistent marketing trends. This is believed to be the result a seasonal availability of pelagic fish and difficulties in developing a consistent market for locally-caught fish. In addition, imported fish from other islands around the region has contributed to the continued marketing problem for local fishermen.

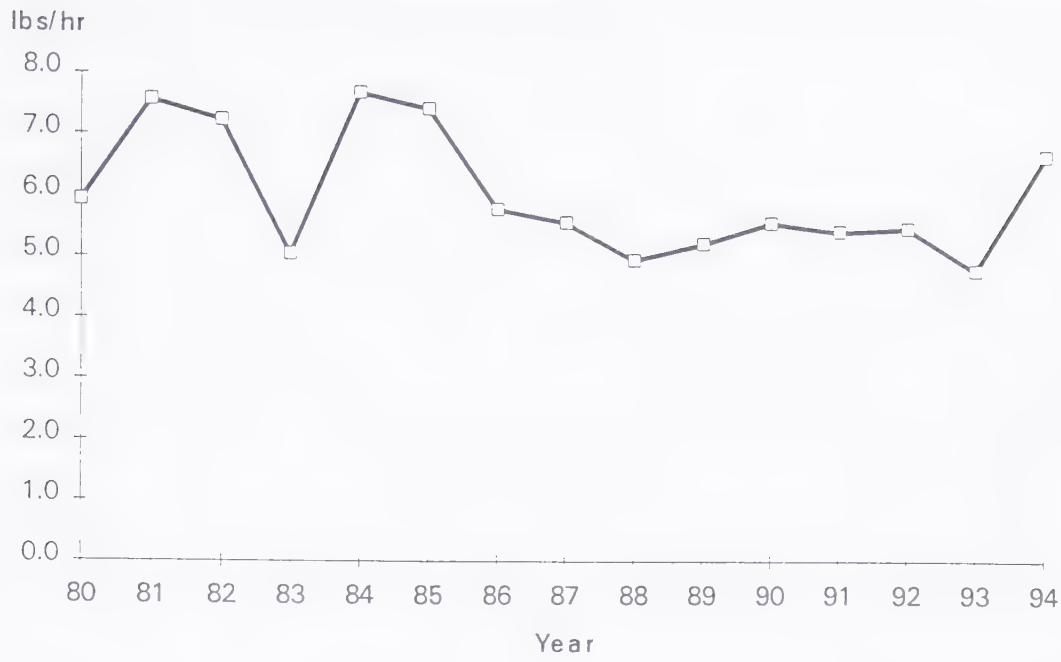

Figure 6. Guam Bottomfish CPUE

Year	CPUE (lbs/hr)
1980	5.9
1981	7.6
1982	7.3
1983	5.1
1984	7.7
1985	7.5
1986	5.8
1987	5.6
1988	5.0
1989	5.3
1990	5.6
1991	5.4
1992	5.5
1993	4.8
1994	6.7

Source: The DAWR creel survey data for the bottom fishing method.

Calculations: The catch per hour for each bottomfishing trip surveyed is treated as a separate observation in calculating the average CPUE for the bottomfishing method. The sum of the individual trip CPUE's for surveyed trips is divided by the total number of surveyed trips.

Interpretations: The annual CPUE fluctuates around 5 to 8 pounds per hour and has remained fairly stable. The decrease in the CPUE between 1992 and 1993 is most likely due to a reduction

in the CPUE of the shallow water bottomfish complex since most of Guam's recreational and subsistence bottomfish fishermen target the shallow water complex. Overall, no problems are indicated by CPUE.

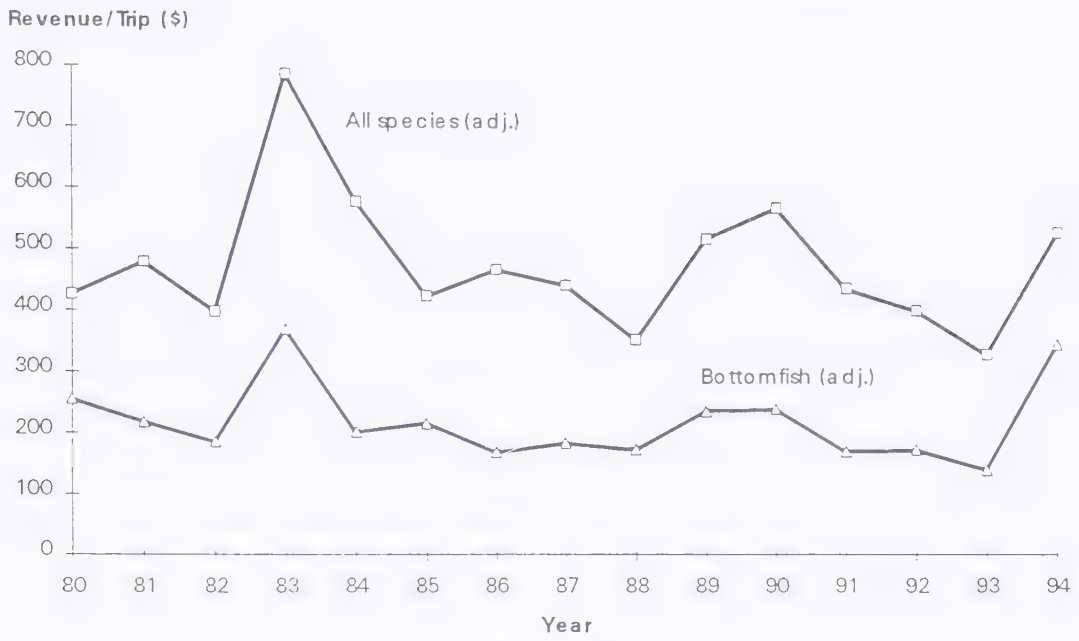

Figure 7. Guam average revenue per trip

	$/Trip (Bottomfish)		$/Trip (All Species)	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted
1980	77	256	129	427
1981	80	218	174	479
1982	71	186	152	398
1983	147	370	312	787
1984	87	202	248	577
1985	96	216	190	424
1986	78	169	215	467
1987	88	184	212	442
1988	87	173	178	353
1989	132	236	290	518
1990	154	240	363	568
1991	120	170	308	437
1992	134	173	311	401
1993	118	140	277	329
1994	346	346	528	528

Source: The commercial landings data from major wholesalers.

Calculations: The average revenue per trip for all species is calculated by summing the revenue of all species sold for any trip which landed bottomfish species, and dividing by the number of

trips. The average bottomfish revenue per trips is calculated from those same trips by summing the sales of only bottomfish species and dividing by the number of trips.

Interpretations: The inflation-adjusted average revenue per trip does not appear to show any single long-term trends or cause for concern. The increase in the amount of imported bottomfish from around Micronesia (Palau, Chuuk, Pohnpei, etc.) that began sometime around 1991 with the addition of frequent airline routes to Guam may explain the slight decrease in revenues between 1991 and 1993. The substantial increases in the inflation-adjusted average revenue per trip in 1994 are best explained by the success of the highliner vessels during that year.

Appendix 3

Hawaii

Introduction

The commercial bottomfish stocks in the Hawaiian Islands are divided into two fisheries: seamount groundfish and deep-slope bottomfish. The seamount fishery targets alfonsin, *Beryx* spp., and armorhead, *Pseudopentaceros wheeleri*. The only area in the US EEZ for this fishery is Southeast Hancock Seamount located 1,400 nm northwest of Honolulu. This trawl fishery was started by the Russians and Japanese in the late 1960s and large catches were made for about 10 years until they caused a crash in the fishery. This fishery has never been domestically harvested. A moratorium on fishing within the US EEZ began in 1986 and continues through the present as no substantial recovery in the fishery has been observed.

The deep-slope bottomfish fishery in Hawaii concentrates on species of eteline snappers, carangids, and a single species of grouper concentrated at depths of 30-150 fathoms. These fish have been fished on a subsistence basis since ancient times and commercially for at least 90 years. The deep-slope fishing grounds within the US EEZ are divided into three management zones. The inhabited main Hawaiian Islands (MHI) support numerous subsistence, recreational, and commercial fishermen with considerable overlap by category. The uninhabited Northwestern Hawaiian Islands (NWHI) are divided into the Mau Zone, closer to the MHI, and the Hoomalu Zone. Fishing in these zones is conducted solely by commercial fishermen and requires federal licensing for such activities. The Hoomalu Zone is a limited entry zone with 5 vessels participating in 1994; 12 vessels fished the Mau Zone in the same year.

Vessel size varies considerably with larger fully commercial vessels (30 ft in length and over) conducting trips of about 10 days, and smaller vessels (<30 ft) generally restricted to the MHI and trips of 1-3 days. Most vessels in this fishery are fully outfitted with electronic navigation and fish-finding equipment, as well as with electric or hydraulic line-hauling equipment. The catch is sold fresh in the round for local consumption.

Catch and revenue data for bottomfish have been collected by the State of Hawaii Division of Aquatic Resources (HDAR) since 1947 in the form of a report submitted by commercial fishermen. No data is collected for recreational or subsistence fishermen, but their catch is estimated to be about equal to the commercial catch in the MHI. Data obtained from a market monitoring program and data from fishermen interviews are combined with the HDAR data set for the analysis presented in this report.

Summary

The MHI bottomfish fishery has remained relatively stable over the last few years. Landings increased sharply in 1994 as compared to 1993 due to a similar increase in effort (CPUE remained nearly constant). Stocks of many of the BMUS species in this zone are stressed. Onaga is overfished by definition since the SPR is below 20%. Other species have yellow light conditions due to drops in CPUE below 50% of original values. In the case of ehu in the MHI, targeted CPUE is down to about 11% of original, clearly deserving of concern.

Bottomfish stocks in the NWHI appear to remain healthy. CPUE is 63% of the original level in the Mau Zone and 55% in the Hoomalu zone. Analysis of SPR and percent immature in the catch show no problems to date.

Armorhead stocks outside of the US EEZ experienced a short pulse in recruitment in 1992 which did not carry over into 1993. SPR values at Southeast Hancock Seamount are the highest since 1986, but at 2.5% in 1993 they still indicate a collapsed fishery. Data for 1994 is not available.

Recommendations

1) The BPT remains concerned about the continuing overfished condition of the MHI onaga and ehu stocks. The BPT supports the ongoing efforts of the DLNR bottomfish task force toward establishing management regulations for the MHI fishery and anticipates a timely solution.

2) Again, the BPT strongly encourages the State to proceed expeditiously with computerization of the fish and seafood dealer reporting system and integrate this with the fishermen's commercial catch reporting system.

3) Again, the BPT strongly encourages NMFS and the State to increase the level of bottomfish catch monitoring of the Honolulu auction (reduced from 6 to 2 days per week) and expand this sampling to major dealers on all other main Hawaiian Islands.

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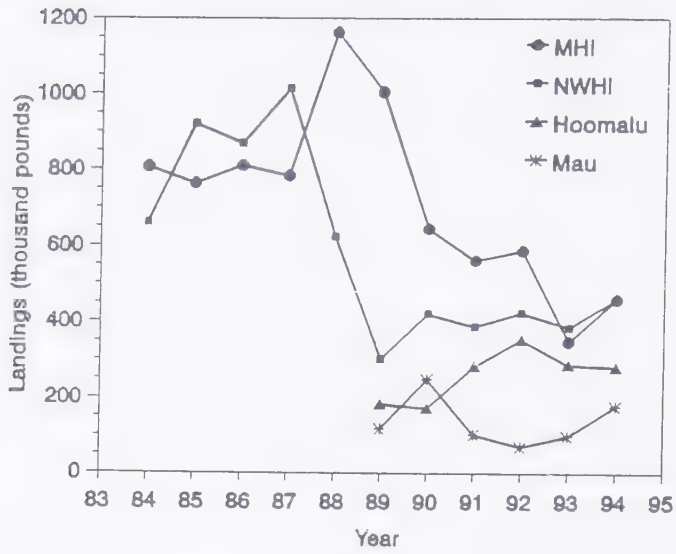
Figure 1. Hawaii's bottomfish landings from the NWHI and MHI



Year	Landings (1000 lb)			
	Mau	Hoomalu	Total NWHI	MHI[2]
1984	NA	NA	661	807
1985	NA	NA	922	763
1986	NA	NA	869	810
1987	NA	NA	1015	783
1988	NA	NA	625	1164
1989	118	184	303	1006
1990	249	173	421	645
1991[1]	103	283	387	561
1992[1]	71	353	424	587[3]
1993[1]	98	287	385	348[3]
1994[1]	178	281	459	458[3]

[1] NWHI data from combination NMFS and HDAR
[2] Data from HDAR
[3] Preliminary data

Source: NWHI landings data for 1984-90 collected by National Marine Fisheries Service (NMFS) Honolulu Laboratory's market monitoring program. The 1991-94 NWHI landings are a combination of NMFS and HDAR data. MHI landings are from HDAR data. Data for bottomfish includes BMUS and other bottomfish.

Calculation & Adjustment: NMFS data are presented as an expanded estimate to approximate the total market volume. Market expansion factors are based on a 1979 survey of wholesale

markets in Hawaii and on the landing patterns of specific fleets. The 1991-93 data set is a combination of the NMFS and HDAR data which has been adjusted to account for missing trips MHI landings are unadjusted for recreational landings.

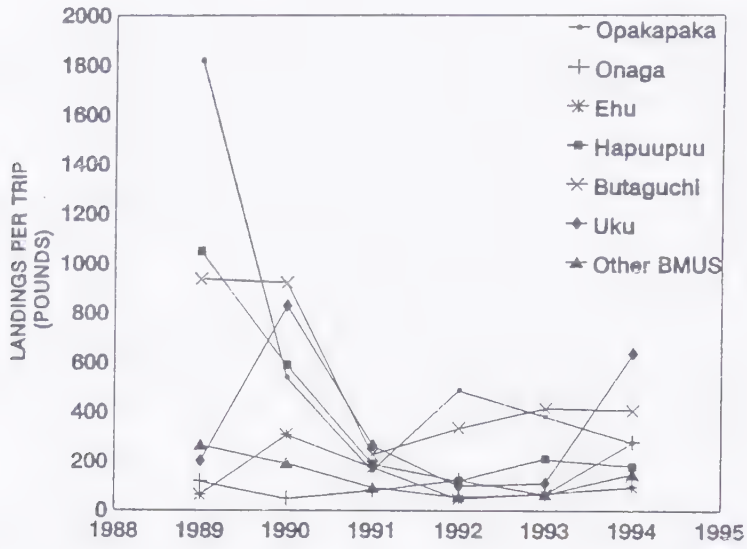
Comments: The overall 1994 NWHI landings showed an increase back to just above the 1992 level. Preliminary data for the MHI landings exhibited a large increase over 1993 and they nearly equal those of the NWHI.

The Mau Zone landings increased substantially while the number of trips increased only slightly. Landings in the Hoomalu Zone remained stable while the number of trips increased substantially.

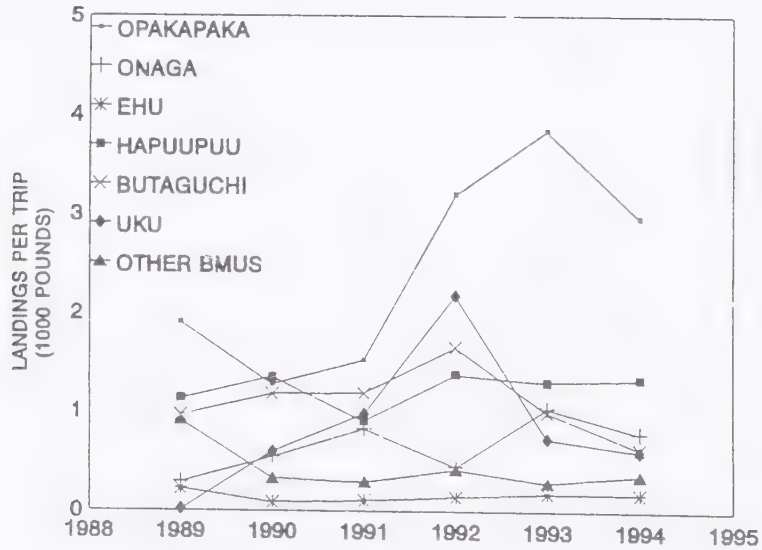
Interpretation: Trends in landings have generally followed trends in effort for the various fishing zones (see Figs. 6 and 8). Deviations from this relationship exhibited in the last 7-8 years have been attributed to the abundance of uku.

An increase in the uku catch was responsible for the dramatic increase in the 1994 Mau zone landings. In the past uku has been responsible for the high volume of landings in 1988 for the MHI, in 1990 for the Mau Zone and in 1992 for the Hoomalu Zone.

Figure 2. Northwestern Hawaiian Islands BMUS species composition of landings per trip, by weight, for the Mau and Hoomalu Zones



Mau Zone Landings per Trip, 1989-1994.



Hoomalu Zone Landings per Trip, 1989-1994.

NWHI BMUS average pounds per trip by species, Mau Zone

Species	1989	1990	1991[1]	1992[1]	1993[1]	1994[1]
Opakapaka	1820	541	163	488	382	277
Onaga	120	49	83	124	66	139
Ehu	65	309	176	48	69	96
Hapuupuu	1050	590	189	121	210	179
Butaguchi	938	923	228	336	415	407
Uku	202	830	266	100	112	637
Other BMUS	268	193	94	56	67	148
Total per trip	4463	3435	1199	1273	1321	1883

[1] Data from combination of NMFS and HDAR data sets.

NWHI BMUS average pounds per trip by species, Hoomalu Zone

Species	1989	1990	1991[1]	1992[1]	1993[1]	1994[1]
Opakapaka	1910	1284	1530	3208	3849	2976
Onaga	293	550	837	450	1042	791
Ehu	231	94	113	148	185	177
Hapuupuu	1138	1357	913	1386	1305	1340
Butaguchi	969	1185	1196	1660	1004	633
Uku	20	600	985	2187	736	606
Other BMUS	920	333	297	425	291	365
Total per trip	5481	5403	5871	9464	8412	6888

[1] Data from combination of NMFS and HDAR data sets.

Source: Data for 1991-94 are from a combination of NMFS and HDAR data.

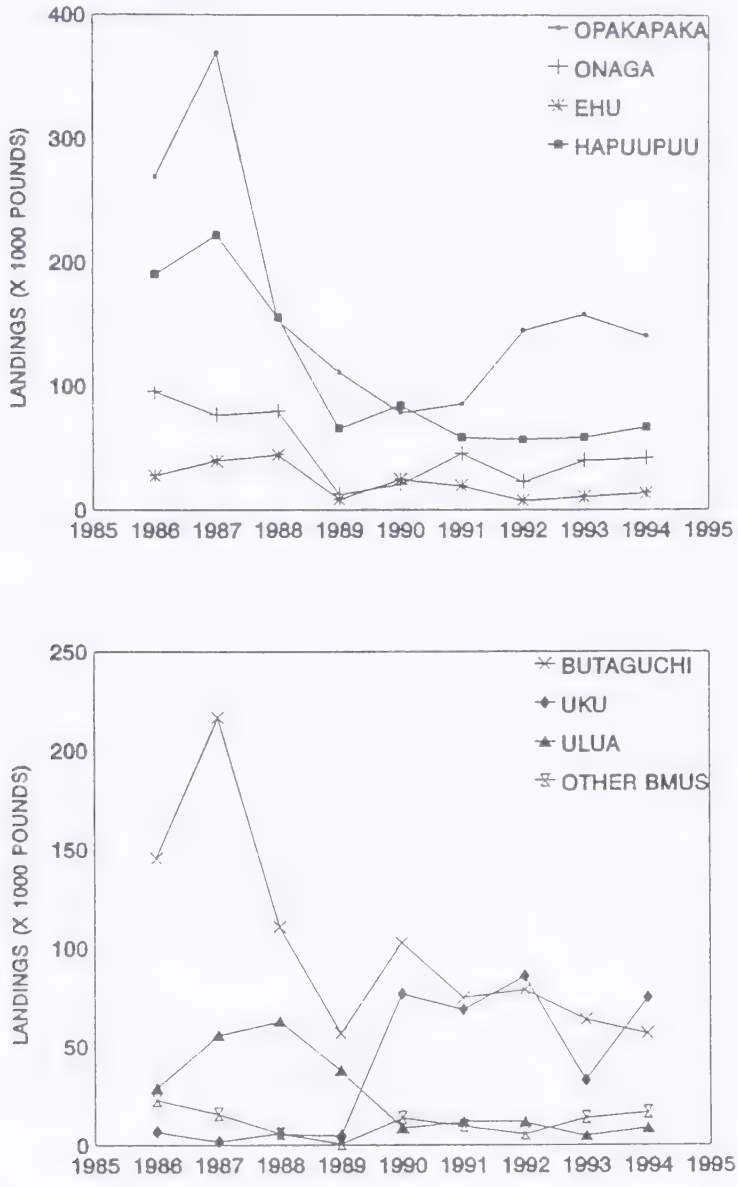
Comments: The average per trip landings for the Mau Zone increased by over 500 pounds last year. Landings of opakapaka, the major target species, have decreased while landings of onaga have increased somewhat. The increased landings of ehu is probably an effect of the increased effort directed toward onaga. The landings of uku have risen close to the 1990 volume.

Landings per trip for the Hoomalu Zone dropped for the second consecutive year. The uku landings have decreased somewhat also.

Interpretation: The large increase in catch per trip observed in the Mau Zone can be directly attributed to increased uku catches. The uku catches have nearly returned to 1990 levels in the Mau Zone.

Decreased landings from the areas fished in 1993 have prompted vessels in the Hoomalu Zone to fish farther up the island chain. As evidenced by the declining catches during the last 2 years, fishing has not gotten any easier. Per trip uku landings continue to decline after the 1992 peak.

Figure 3. NWHI BMUS species composition of landings by weight



Species	1986	1987	1988	1989	1990	1991[1]	1992[1]	1993[1]	1994[1]
Opakapaka	270	370	154	112	79	86	145	158	141
Onaga	96	77	80	13	21	46	23	40	42
Ehu	28	40	45	9	25	20	8	11	14
Hapuupuu	191	223	156	66	85	59	57	59	67
Butaguchi	146	217	111	57	103	75	79	64	57
Uku	7	2	6	5	77	69	86	33	75
White ulua	29	56	63	38	9	12	12	5	9
Other BMUS	23	16	6	1	14	10	6	14	17

[1] Data from a combination of NMFS and HDAR data.

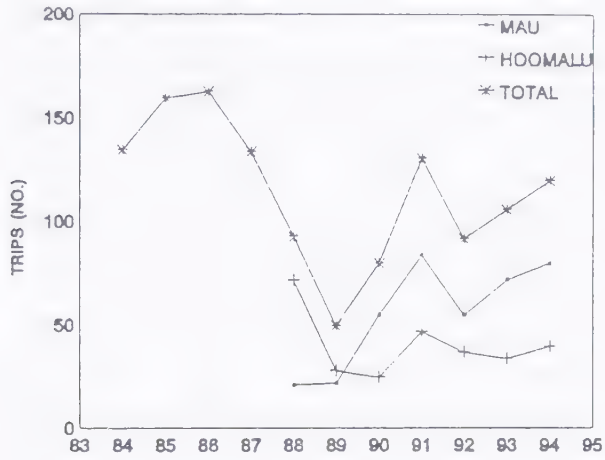
Source: Landings data are collected by Honolulu Laboratory's market monitoring program. Data from 1987-1990 are expanded NMFS estimates. The 1991-1994 data are from a combination of NMFS and HDAR data.

Interpretation: Opakapaka landings declined and onaga landings rose slightly in 1994. The uku landings which peaked in 1990 in the Mau Zone and in 1992 in the Hoomalu Zone appear to be increasing in the Mau Zone again while still at a low level in the Hoomalu Zone. Landings of other bottomfish have remained relatively stable for the past several years.

Butaguchi landings have again decreased and, although this may not be an indication of any stock related decrease, the numbers of released butaguchi are large at times and represent a large quantity of valuable resource that should not be wasted. Tagging of released fish has been suggested by some fishermen. The fishing mortality and its effect on the stock stemming from these releases are not known.

Butaguchi have a shelf-life problem, as well as a low value, and often are discarded during the early part of the trip. They are kept during the latter part of the trip to balance out the load or to "make weight" when more valuable species cannot be caught.

Figure 4. Number of trips made by NWHI bottomfish fleet, Mau and Hoomalu Zones



Source: Trip data collected by Honolulu Laboratory's monitoring program. The 1991-1994 data are the result of a combination of NMFS and HDAR data sets.

Interpretation: The limited entry program started in 1989. The 1990 number of Mau Zone entrants increased due to the limited access into the Hoomalu Zone. The increase in participation consequently resulted in an increase in the number of trips. In 1991 the Mau Zone shows a trip count increase which is due to the combined data set used. The hurricane "Iniki" that hit the Hawaiian island chain during the latter part of 1992 severely restricted the activities of the Kauai based fishing fleet for part of the 1993 season.

There was an increase in the number of trips to both areas in 1994. The 1994 season saw an increased effort in the Mau Zone by a couple of new vessels. One vessel in particular has made a large impact on landings and trips.

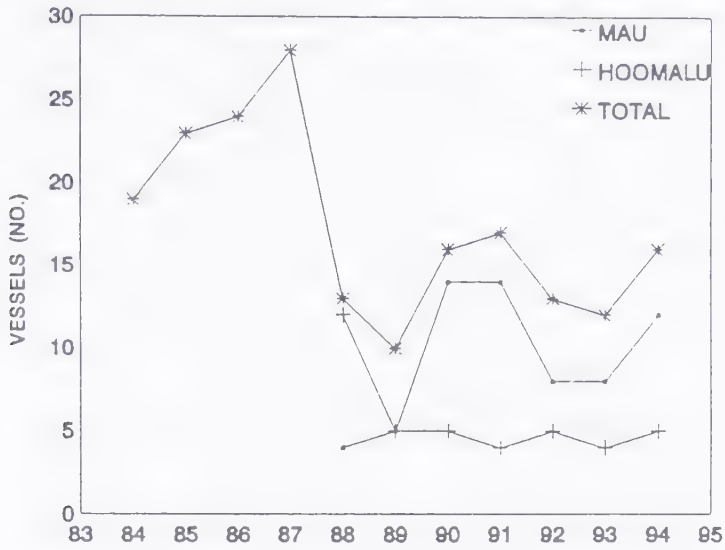
The Hoomalu Zone fleet increased the number of trips by 6 in 1994 with the addition of two vessels. One of these vessels is committed to the bottomfish fishery while the other is a part-time bottomfish fisherman.

Figure 4 data summary:

	Trips		
Year	Mau	Hoomalu	Total
1984	NA	NA	135
1985	NA	NA	160
1986	NA	NA	163
1987	NA	NA	134
1988	21	72	93
1989	22	28	50
1990	55	25	80
1991[1]	84	47	131
1992[1]	55	37	92
1993[1]	72	34	106
1994[1]	80	40	120

[1] Based on combined NMFS and HDAR data.

Figure 5. Number of vessels in the NWHI bottomfish fleet, Mau and Hoomalu Zones



Source: Vessel participation data collected by Honolulu Laboratory's market monitoring program. The 1991-94 data are the result of a combination of NMFS and HDAR data sets.

Comments: The number of vessels participating in the NWHI bottomfishery in the Hoomalu zone has remained stable since the implementation of the limited access plan. The Mau Zone participation has fluctuated to a greater degree than can be seen just by looking at the numbers. The turnover rate in the Mau Zone is high as many fishermen try their luck. There remain a few hardcore fishermen that continue to make it year in and year out. Many of the Kauai based vessels have returned to fishing.

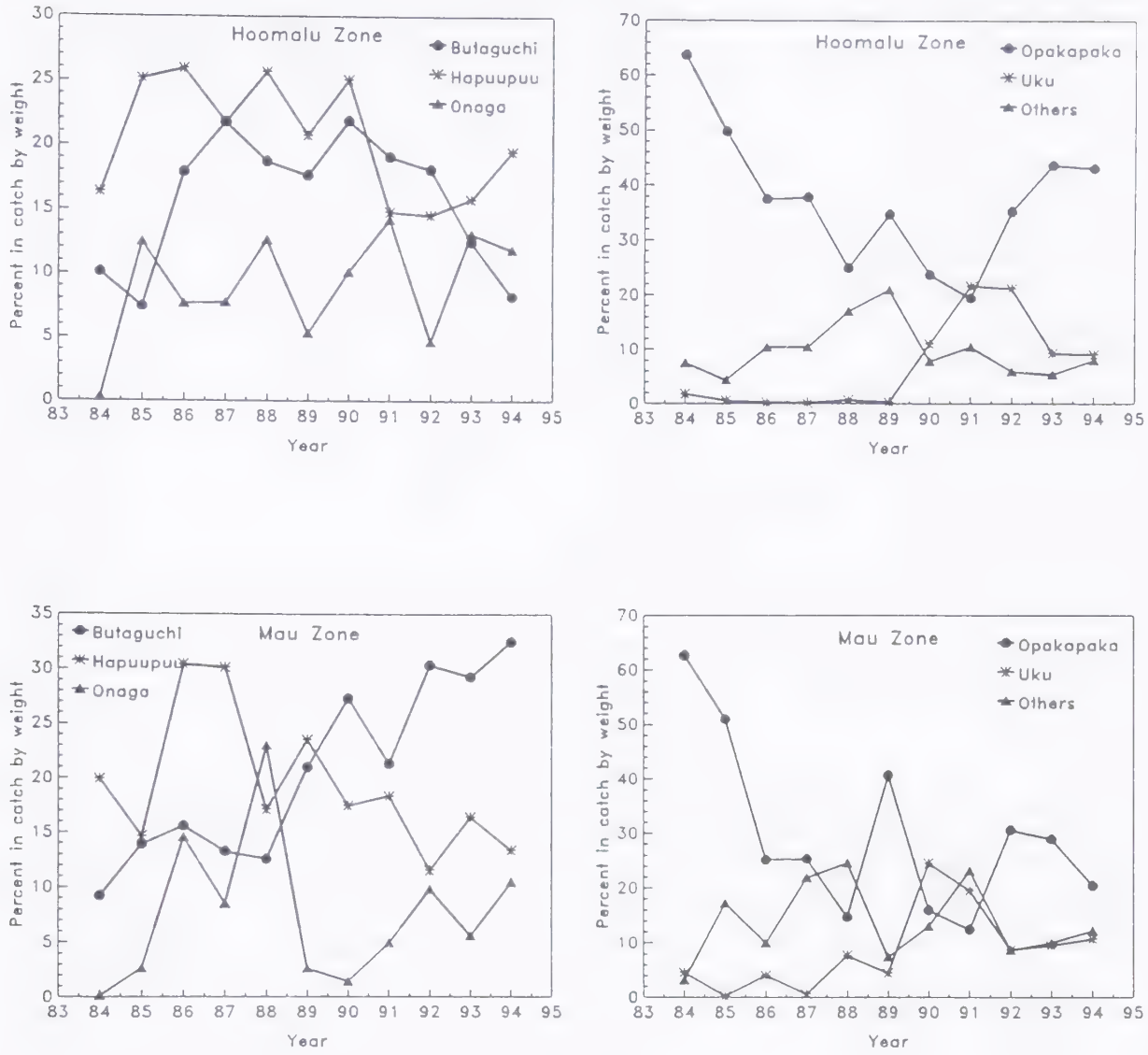
Interpretation: The increase of vessels experienced in 1990-1991 was due to the limited entry program, started in 1989, forcing all new entrants into the Mau Zone. Hoomalu zone participation has remained at a relatively constant level. The participation from 1990-94 shows a stable number of participants.

Figure 5 data summary:

	Boats		
Year	Mau	Hoomalu	Total[2]
1984	NA	NA	19
1985	NA	NA	23
1986	NA	NA	24
1987	NA	NA	28
1988	4	12	13
1989	5	5	10
1990	14	5	16
1991[1]	14	4	17
1992[1]	8	5	13
1993[1]	8	4	12
1994[1]	12	5	16

[1] Based on a combination NMFS and HDAR data set.
[2] Total may not match sum of areas due to vessel participation in multiple areas.

Figure 6. NWHI bottomfish catch composition



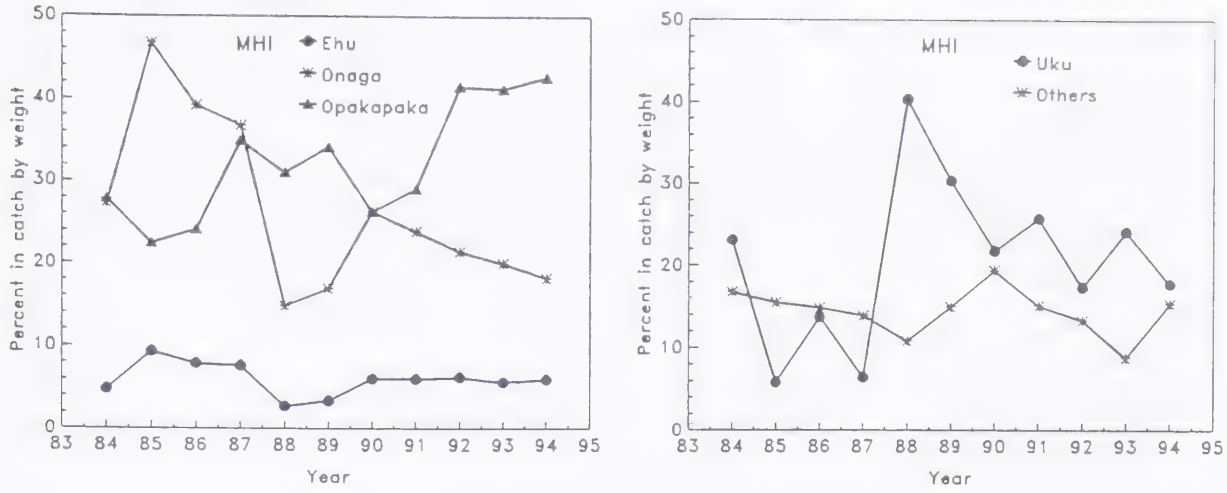
Source: Catch composition data collected at the Honolulu UFA auction by HDAR, NMFS and WPRFMC personnel, and the NMFS vessel interview program.

Calculation & Adjustment: Catch composition is expressed as percent of total bottomfish weight.

Comments: In the Mau Zone opakapaka and hapuupuu decreased in the catch while onaga and butaguchi increased. In the Hoomalu Zone the percentage of hapuupuu in the catch increased while that of butaguchi decreased, opakapaka and onaga levels remained nearly unchanged.

Interpretation: Interpretation of annual changes in species composition is difficult as they include fluctuations due to changes in targeting, abundance, and relative changes with other species. An example of the later type of change would be apparent decreases in percent composition of most species during a strong year of uku catches even though abundance of other species may not have changed or the share of effort expended on catching them.

Figure 7. MHI bottomfish catch composition



Source: Catch composition data collected at the Honolulu UFA auction by HDAR, NMFS and WPRFMC personnel.

Calculation & Adjustment: Catch composition is expressed as percent of total bottomfish weight.

Statistical Analyses: Kendall's tau, Spearman's rho, and Kendall's W (overall concordance) tests were applied to the ranked data to test for consistency in the catch composition 1) over time, and 2) between areas, for the data presented here and on Fig. 2. Yearly blocks of species' rankings for each area were used in 1), and area blocks of yearly rankings for each species were used in 2). To minimize the number of comparisons in 1), 3 year averages were used (4 for the time block of 1990-93). Table 1 shows the results of the tests; significance is designated at $p<0.05$ by an asterisk following the K, S, or KW. Significance in the K and S tests indicate correlation between the pairs of ranks; significance in the KW test indicate concordance over all the ranks examined. The species referred to as ULT is pooled ulua, lehi, and taape.

Comments: The percentage of opakapaka in the MHI catch has remained high in 1994. The percentage of uku decreased in 1994 while the others category increased in the catch. Onaga and ehu composition remained stable. Statistical analysis shows that species composition is generally consistent over time for each area, but there is little correlation between areas.

Interpretation: The high percentage of uku in the 1988 catch is due to an unusual abundance of this species in the MHI during that year. The low percentage of opakapaka for that year is a direct result of the high uku catches. Reasons for the variation in the catch composition of other species and years are not known at this time.

Table 1. Consistency in catch composition over time and between areas

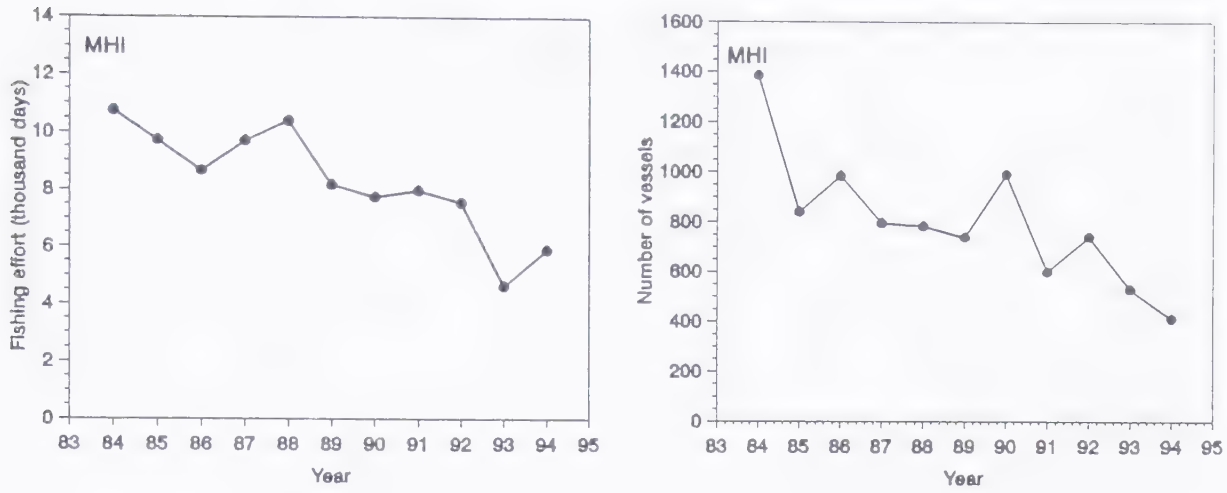
MHI	KW*			
1984-1986	:	1987-1989	K*	S*
1987-1989	:	1990-1993	K*	S*
1984-1986	:	1990-1993	K*	S*

MAU	KW*			
1984-1986	:	1987-1989	K*	S*
1987-1989	:	1990-1993	K*	S*
1984-1986	:	1990-1993	K	S*

HOOMALU	KW*			
1984-1986	:	1987-1989	K*	S*
1987-1989	:	1990-1993	K*	S*
1984-1986	:	1990-1993	K*	S*

	MHI : MAU		MAU : HOO		MHI : HOO		
OPA	K	S	K*	S*	K	S	KW
ONA	K	S	K	S	K	S	KW
HAP	K	S	K	S	K	S	KW
BUT	K	S	K	S	K*	S*	KW
EHU	K	S	K	S	K	S	KW
KAL	K	S	K	S	K*	S*	KW
GIN	K	S	K	S	K	S	KW
UKU	K	S	K*	S*	K	S	KW*
ULT	K	S	K	S	K	S	KW

Figure 8. Standardized MHI bottomfishing trips & vessels



Year	Trips	Vessels
1984	10769	1386
1985	9747	841
1986	8682	985
1987	9719	797
1988	10415	785
1989	8190	739
1990	7764	992
1991	7991	601
1992	7574	742
1993	4647	532
1994	5907	414[1]

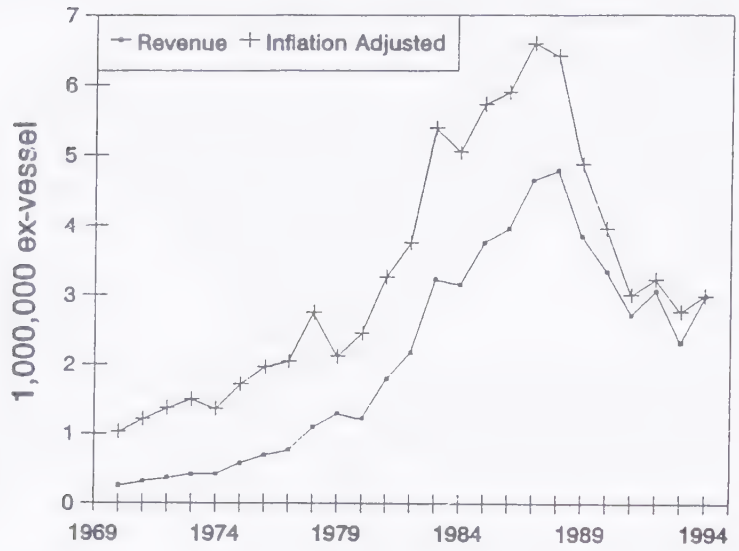
[1] Value based on first 4 months of data

Source: Fishing effort and vessels estimates based on commercial HDAR C-3 catch report data.

Calculation & Adjustment: MHI trips and vessels estimated from annual total MHI bottomfish landings, mean CPUE, and mean total landings per vessel. These estimates represent standardized units of Maui-Molokai-Lanai-Kahoolawe (MLMK) bottomfishing trips and vessels as applied to the entire MHI region. The MLMK criteria for MHI CPUE are described in Fig. 14-A. All values have changed slightly from previous year's reports due to modifications in the calculation. A preliminary expansion factor is used to estimate unreported recreational landings (from Hamm and Lum, 1992). Effort estimates are based on calendar year and are essentially complete for 1994 whereas the participation estimates are based on fiscal year (due to the need to track individual license numbers) and are incomplete for 1994.

Interpretation: Effort in the MHI fishery increased in 1994 after several years of decline. The increase, however, is insufficient to reach 1992 levels. The estimated number of vessels in the fishery continued the declining trend, but the current 1994 estimate is anticipated to increase as further data from FY 1994 is incorporated.

Figure 9. Hawaii bottomfish landings revenue



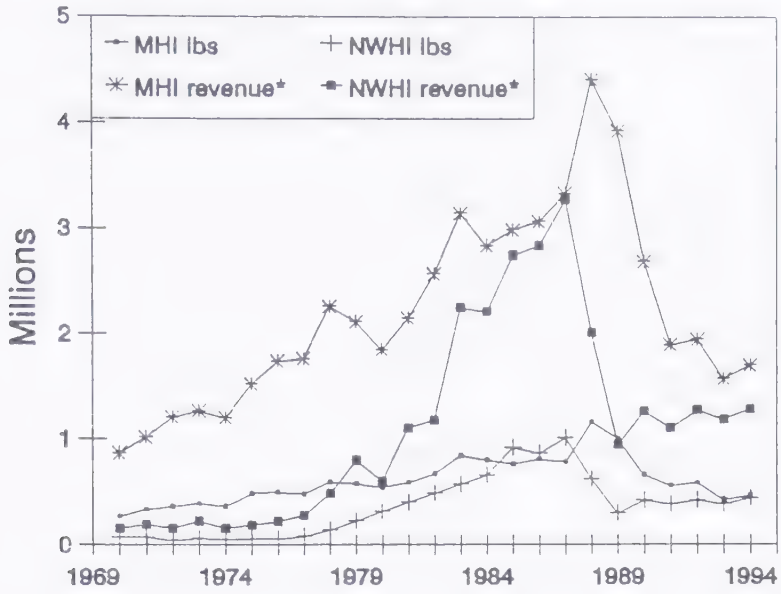
Source: Data are compiled from the NMFS shoreside monitoring program for the NWHI, and HDAR commercial catch reports.

Calculation & Adjustment: NWHI estimates for 1984-90 are compiled solely from NMFS shoreside monitoring. NWHI estimates for 1970-83 and 1991-94 are compiled from HDAR commercial catch reports, and a combination of NMFS and HDAR data, respectively. Prices are at the ex-vessel level.

Revenue adjusted for inflation (*) is calculated by multiplying each year's nominal (actual) revenue by the ratio of the 1994 Honolulu consumer price index (CPI) to each year's CPI. This adjusts early year revenues to the same purchasing power basis as 1994 revenue.

Interpretation: The time-series shows a dramatic decline since the late 1980s, leveling off since 1991. Both NWHI and MHI landings have declined over the same period.

Figure 10. Hawaii bottomfish landings and revenue by source

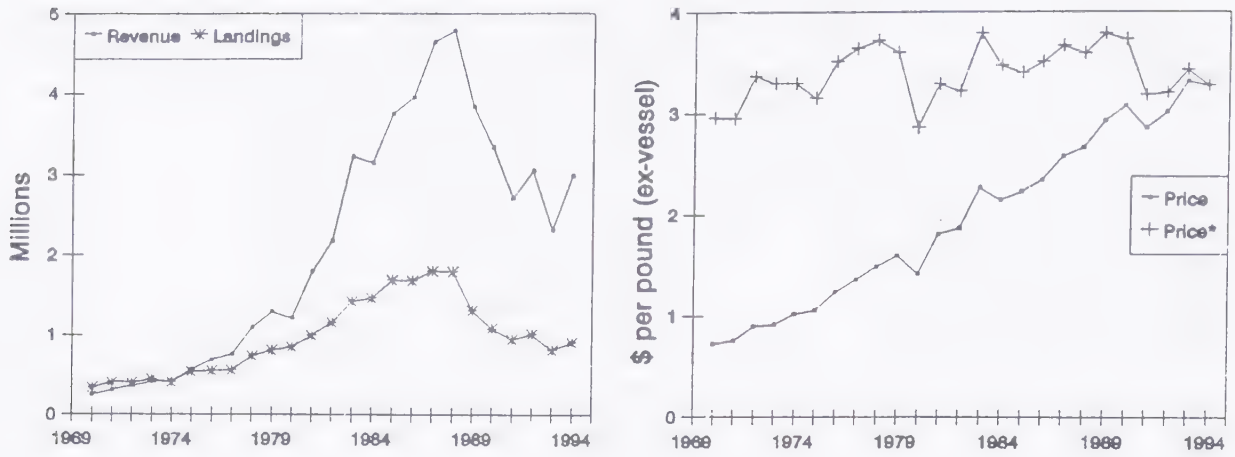


Source: NWHI landings and revenue data are collected by the NMFS shoreside monitoring program. MHI landings and revenue data are compiled from HDAR commercial catch reports.

Calculation & Adjustment: Revenue adjusted for inflation (*) is calculated by multiplying each year's nominal (actual) revenue by the ratio of the 1994 Honolulu consumer price index (CPI) to each year's CPI. This adjusts early year revenues to the same purchasing power basis as 1994 revenue.

Interpretation: Overall bottomfish landings and market dollar volume (adjusted for inflation) have fallen since the late '80s, leveling off somewhat since 1991.

Figure 11. Hawaii bottomfish landings, revenue, and price



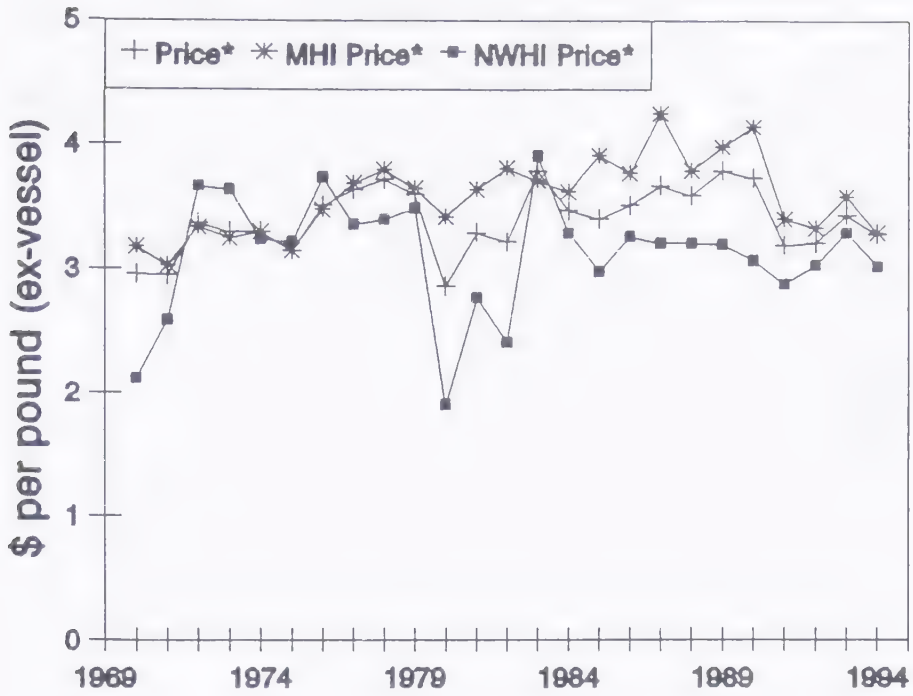
Source: Data are from the NMFS shoreside monitoring program for the NWHI, and HDAR commercial catch reports data tapes compiled by NMFS with the GAS (HDAR Gear-Area-Species summary compilation) computer programs.

Calculation & Adjustment: Revenue represents ex-vessel revenue, and is the overall average price for all bottomfish species combined.

Revenue and price (*) adjusted for inflation are calculated by multiplying each year's nominal (actual) value by the ratio of the 1994 Honolulu consumer price index (CPI) to each year's CPI. This adjusts early year dollar values to the same purchasing power basis as 1994 dollar values.

Interpretation: These values differ from previous reports in that combined NMFS/HDAR estimates of landings, revenue, and price are used. These figures show the growth of the domestic bottomfish fishery from the mid-1970s through the late-1980s, coincident with an increase in inflation-adjusted average price. The latter represents strong marketing of the bottomfish product, which also probably encouraged continued fishing pressure. Inflation-adjusted average price appears to be relatively stable in recent years; however, total revenue and landings continue to decline since the late 1980s.

Figure 12. Hawaii bottomfish average prices by source



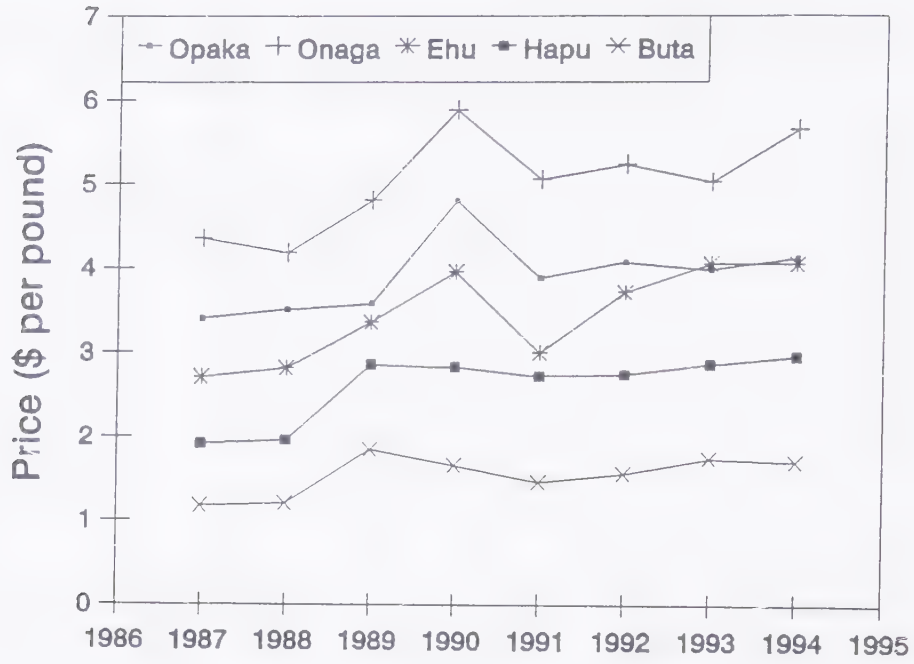
Source: Data are from NMFS monitoring of NWHI landings and HDAR commercial catch reports for NWHI and MHI landings. Import volume (pounds) is recorded by the NMFS Southwest Region's Market News program.

Calculation & Adjustment: Data from the MHI and NWHI sources and from imports were combined by NMFS into the average market category (labeled "Price" in Fig. 12). NWHI average prices are used to estimate import market dollar volume.

Inflation-adjusted revenue and prices (*) are constructed by multiplying each year's nominal (actual) revenue or average price by the ratio of the 1994 Honolulu consumer price index (CPI) to each year's CPI. This adjusts early year revenues and prices to the same purchasing power basis as 1994 revenue and average price.

Interpretation: Overall average prices for MHI landings are generally greater than NWHI landings. Inflation-adjusted prices have decreased slightly in 1994.

Figure 13. Hawaii bottomfish average prices by species



Source: MHI data are from HDAR commercial catch reports. NWHI data are from NMFS shoreside monitoring. Import revenue data are compiled by the NMFS Southwest Region's Market News program from U.S. Food & Drug Administration monitoring of shipments into the Honolulu Customs District.

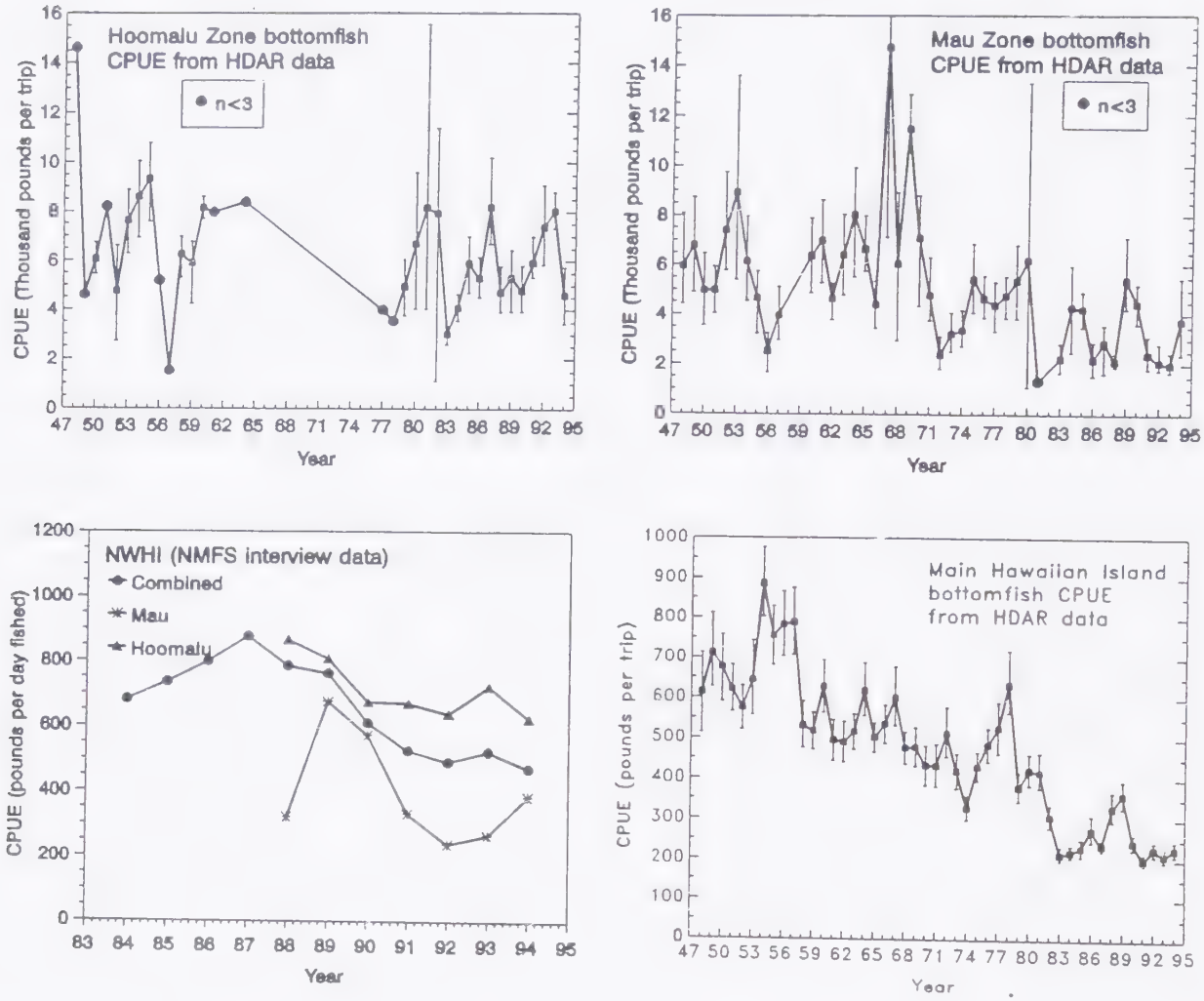
Calculation & Adjustment: Average price data are calculated by NMFS by combining MHI and NWHI estimates of landings and revenue. Import prices are NWHI overall average prices.

Interpretation: Prices for most bottomfish species remained relatively stable in 1993, although onaga prices have increased in 1994.

Table 2. Hawaii bottomfish data. Tabled values are 1000s of pounds landed, $1000s ex-vessel, or $/lb ex-vessel. An * denotes inflation-adjusted values. (Compiled from Pooley spreadsheet 5/25/94.)

Year	Total lb	MHI lb	NWHI lb	Total $	Total $*	MHI M$*	NWHI N$*	Total $/lb	Total $/lb*	MHI $/lb*	NWHI $/lb*
1948	1058	763	295	455	2952	2258	694	0.43	2.79	2.96	2.35
1949	1069	753	316	449	2961	2202	759	0.42	2.77	2.93	2.41
1950	905	550	355	304	2065	1446	618	0.34	2.31	2.66	1.76
1951	894	525	369	332	2162	1380	782	0.37	2.41	2.62	2.12
1952	1078	544	534	418	2615	1527	1089	0.39	2.44	2.82	2.06
1953	960	495	465	370	2286	1427	859	0.39	2.41	2.92	1.87
1954	707	424	283	267	1637	1171	466	0.38	2.33	2.79	1.66
1955	748	414	334	300	1838	1213	625	0.40	2.45	2.92	1.87
1956	648	512	136	292	1758	1472	287	0.45	2.71	2.88	2.11
1957	558	465	93	259	1520	1309	211	0.46	2.70	2.78	2.24
1958	525	462	63	240	1325	1215	110	0.46	2.54	2.64	1.76
1959	403	335	68	212	1148	1007	141	0.53	2.87	3.03	2.08
1960	401	313	88	200	1060	872	188	0.50	2.65	2.78	2.14
1961	384	308	76	188	975	820	155	0.49	2.54	2.66	2.05
1962	439	374	65	220	1118	991	127	0.50	2.54	2.64	1.95
1963	534	442	92	253	1265	1095	170	0.47	2.35	2.45	1.83
1964	515	423	92	244	1220	1060	160	0.47	2.35	2.49	1.73
1965	405	354	51	213	1029	941	87	0.53	2.56	2.67	1.71
1966	459	411	48	237	1112	1028	84	0.52	2.44	2.52	1.76
1967	426	393	33	243	1117	1053	64	0.57	2.62	2.67	1.95
1968	638	605	33	265	1161	1100	62	0.42	1.84	1.84	1.88
1969	419	379	40	277	1175	1112	63	0.66	2.80	2.93	1.59
1970	344	270	74	253	1026	867	158	0.73	2.95	3.18	2.12
1971	410	335	75	312	1211	1016	195	0.76	2.95	3.03	2.59
1972	407	364	43	366	1370	1212	158	0.90	3.37	3.34	3.67
1973	454	392	62	418	1499	1273	226	0.92	3.30	3.25	3.64
1974	413	364	49	421	1362	1204	158	1.02	3.30	3.30	3.24
1975	544	485	59	577	1715	1525	190	1.06	3.15	3.15	3.22
1976	558	499	59	693	1962	1742	221	1.24	3.51	3.48	3.74
1977	562	479	83	764	2045	1767	279	1.36	3.64	3.69	3.36
1978	740	597	143	1100	2746	2262	484	1.49	3.72	3.80	3.40
1979	809	580	229	1296	2916	2116	800	1.60	3.60	3.65	3.49
1980	856	541	316	1218	2453	1850	602	1.42	2.86	3.42	1.91
1981	993	591	402	1794	3261	2151	1111	1.81	3.29	3.64	2.77
1982	1162	673	488	2177	3749	2569	1179	1.87	3.22	3.81	2.41
1983	1422	847	575	3228	5389	3143	2247	2.27	3.79	3.71	3.91
1984	1464	803	661	3147	5045	2835	2210	2.15	3.47	3.62	3.29
1985	1687	765	922	3754	5728	2982	2747	2.23	3.40	3.91	2.98
1986	1680	811	869	3952	5898	3062	2836	2.35	3.51	3.77	3.26
1987	1799	784	1015	4645	6597	3330	3267	2.58	3.67	4.25	3.21
1988	1790	1165	625	4788	6420	4409	2011	2.67	3.59	3.79	3.21
1989	1310	1007	303	3840	4875	3923	952	2.93	3.79	3.98	3.20
1990	1082	661	421	3335	3953	2685	1268	3.08	3.73	4.14	3.07
1991	949	562	387	2713	3000	1894	1106	2.86	3.19	3.40	2.88
1992	1011	587	424	3052	3223	1945	1278	3.02	3.21	3.33	3.03
1993	812	426	386	2312	2761	1573	1189	3.32	3.43	3.58	3.29
1994	911	468	443	2985	2985	1700	1285	3.28	3.28	3.29	3.02

Figure 14-A. CPUE for Hawaiian bottomfish



Source: MHI CPUE is based on HDAR C-3 catch report data from commercial fishermen. Two NWHI CPUE's are presented, one based on the NMFS vessel interview program catch data, and one based on HDAR C-3 catch report data from commercial fishermen.

Calculation & Adjustment: MHI trips were screened to only include trips from the areas of Maui, Lanai, Molokai, and Penguin Banks that had at least 90% of the catch by weight in bottomfish. Additionally, some MHI small boats were excluded based on minimum annual landings criteria to correct for temporal changes in the fleet composition. The NMFS vessel interview data prior to 1988 does not allow separate Mau and Hoomalu CPUE calculations; therefore, the combined area NWHI CPUE is presented as well. The NWHI HDAR CPUE used data screened to only include trips where at least 90% of the catch by weight was bottomfish and at least 1000 pounds of bottomfish were caught. All catch data reported by the same licensee on consecutive days were collapsed to a trip summary, since 1) most other reports are apparent multi-day trip summaries, and 2) consecutive day reporting may be reflective of marketing rather

than fishing activity. There was an apparent absence of Hoomalu Zone trips from the mid-1960s until the late-1970s. The 95% non-parametric confidence intervals for the HDAR CPUE's were calculated by bootstrapping.

Comments: There is a long-term decreasing trend in MHI CPUE, with current values approximately one-third that of initial. The 1994 MHI CPUE value is nearly the same as the 1993 value. MHI trips are generally one day in length, so CPUE values presented here reflect catch per day as well as catch per trip.

The NMFS vessel interview NWHI CPUE for 1994 has increased substantially over the 1993 value for the Mau Zone and decreased slightly for the Hoomalu Zone. The sharp increase in Mau Zone HDAR CPUE values follow those of the NMFS estimate after a general decline since 1989. However, the Hoomalu Zone HDAR CPUE shows a sharp drop in 1994 which is in contrast to the NMFS estimate where the decline is much less severe. The HDAR CPUE is used for NWHI SPR calculations since it is a longer time series and may better estimate virgin fishery catch rates. There are no correction factors for possible changes in trip duration or fleet composition.

Interpretation: Decreases in MHI CPUE to about one-third of early CPUE values signify a yellow light condition for the fishery in this area. The increase in the late 1980s MHI CPUE was due primarily to a large increase in uku catches alone and may not indicate an increase in abundance of other species. And decreases in CPUE from the 1989-90 highs may be a return to normal rather than a decrease in normal abundance. The reasons for differing trends in CPUE values for the Hoomalu Zone with differing data sources are unclear.

Figure 14-A data summaries:

	Pounds/Trip		
Year	MHI	Mau	Hoomalu
1948	614	5968	14635
1949	713	6799	4614
1950	677	4966	6072
1951	621	4980	8228
1952	577	7407	4766
1953	645	8937	7627
1954	887	6158	8613
1955	755	4659	9336
1956	784	2523	5202
1957	789	3958	1535
1958	533	NA	6254
1959	519	NA	5897
1960	630	6379	8139
1961	496	6999	7978
1962	491	4641	NA
1963	518	6410	NA
1964	619	8028	8390
1965	503	6656	NA
1966	536	4413	NA
1967	602	14749	NA
1968	478	6055	NA
1969	480	11484	NA
1970	433	7111	NA
1971	433	4784	NA
1972	514	2386	NA
1973	421	3224	NA
1974	329	3367	NA
1975	430	5439	NA
1976	485	4653	NA
1977	527	4387	4000
1978	635	4753	3550
1979	380	5361	4951
1980	421	6210	6687
1981	416	1336	8167
1982	307	NA	7953
1983	214	2242	3025
1984	220	4308	4085
1985	230	4239	5909
1986	274	2206	5301
1987	237	2889	8187
1988	329	2136	4702

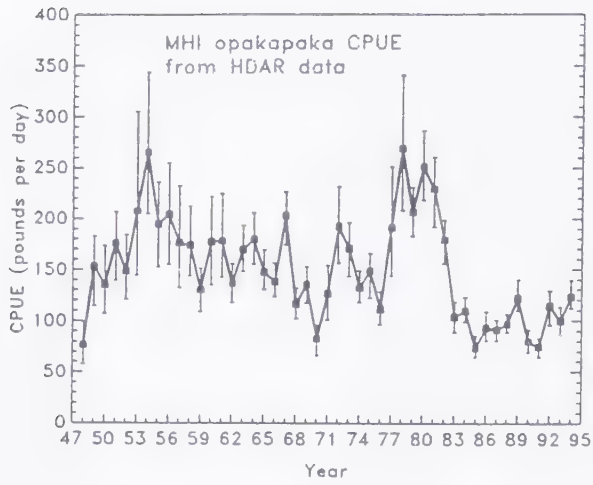
1989	361	5412	5328
1990	245	4454	4793
1991	202	2413	5928
1992	228	2092	7388
1993	213	1992	8040
1994	228	3748	4626

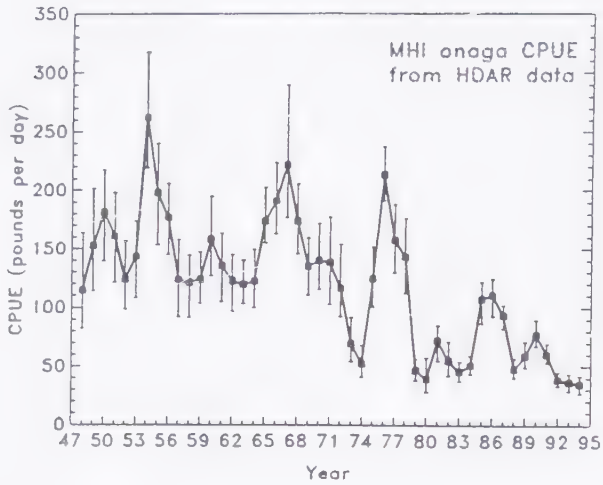
	NMFS NWHI CPUE (lb/day)		
Year	**Mau**	**Hoomalu**	**Combined**
1984	NA	NA	682
1985	NA	NA	736
1986	NA	NA	800
1987	NA	NA	877
1988	322	866	786
1989	677	808	763
1990	573	675	611
1991	333	671	525
1992	239	639	491
1993	267	723	523
1994	385	625	472

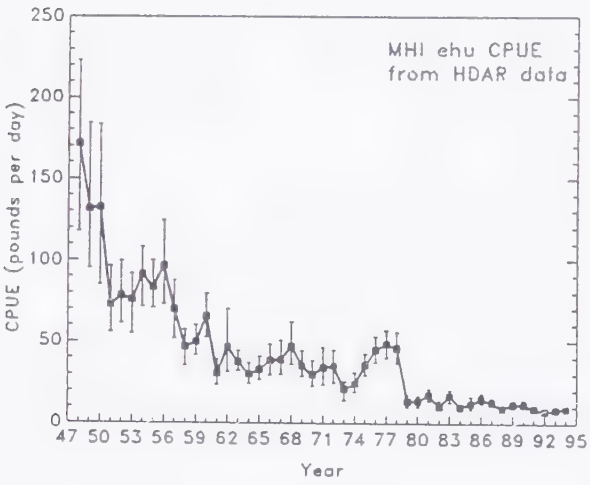
Note on confidence intervals:

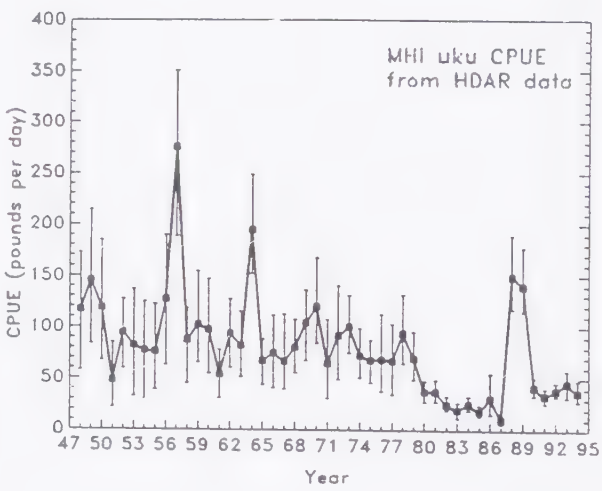
There is extensive literature in which non-normality of CPUE error structure has been documented. In simple terms this means that, on occasion, there are some very large CPUE values which are not "balanced" with correspondingly small CPUE values; this leads to an asymmetric error structure which is not amenable to traditional, parametric confidence interval estimation. The bootstrapped intervals used here are also called non-parametric confidence intervals since there is no assumption of symmetrical error around the average value. If there is a large amount of high-end variability, then the confidence interval above the average value can be of greater span than the confidence interval below the average value, or vice-versa. Traditional methods would average the error and force an **equal** amount of uncertainty to either side of the average value. This is an unnecessary constraint and can lead to misinterpretation. If the error structure **is** symmetrical (i.e., normal), then the intervals derived from the non-parametric approach will mimic the intervals derived from the traditional approach. Alternative approaches such as log-transformation are available; however, such approaches assume a very particular type of asymmetrical error. In contrast, the bootstrap approach offers unconstrained flexibility in the type of error structure contained in the data.

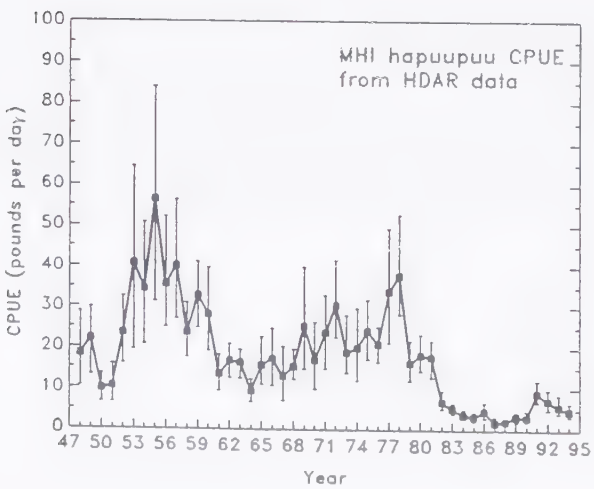
Figure 14-B. Partial CPUE for MHI bottomfish

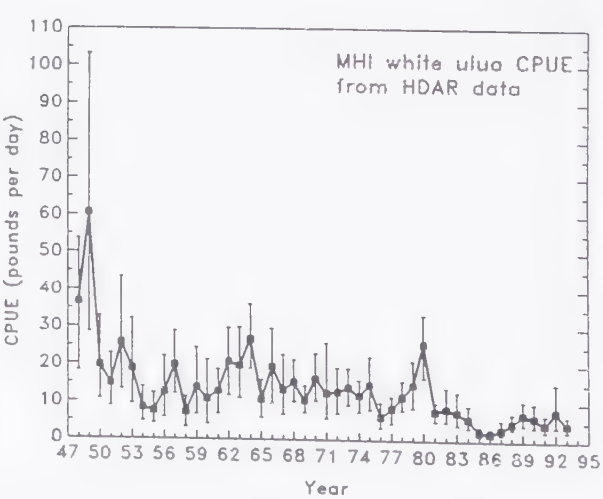












Source: The partial CPUE for the MHI is based on HDAR C-3 catch report data from commercial fishermen.

Calculation & Adjustment: The same subset of HDAR data as used in Fig. 14-A is used here, but the weight of each species is tabulated separately rather than in aggregate. The same denominator value used in Fig. 14-A is used here (# trips fished), i.e. summing these six partial CPUE's (and remaining BMUS CPUE's) will approximate the Fig. 14-A estimates. 95% non-parametric confidence intervals were calculated by bootstrapping.

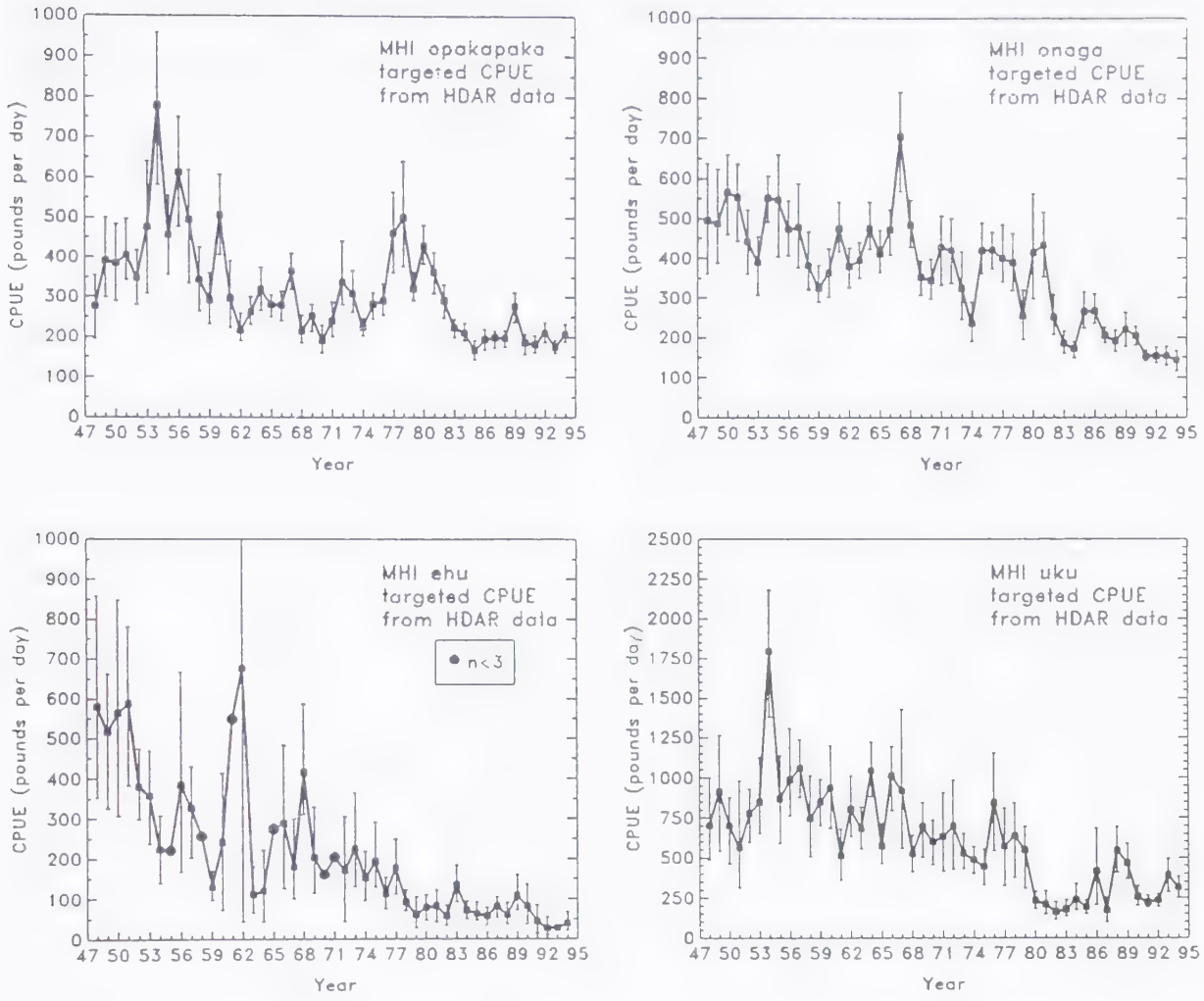
Comments: All CPUE time series remain highly variable. There are apparent declines in most species when comparing several years of recent values with values earlier in the time series. The decline is least apparent in opakapaka and most apparent in ehu. MHI trips are usually of one day duration.

Interpretation: Reduction of species-specific CPUE for species presented here to less than half of their early values would suggest a yellow light situation for these species, especially ehu and onaga. Caution must be used in this interpretation because factors such as targeting of effort to specific species is not taken into account (see next section for targeted effort).

Figure 14-B data summary

	MHI Partial CPUE (lb/trip)					
Year	OPA	ONA	EHU	UKU	HAP	ULU
1948	77	115	172	117	18	37
1949	153	153	132	146	22	61
1950	135	182	132	119	10	20
1951	176	161	73	48	11	15
1952	149	124	78	95	24	26
1953	208	144	76	82	41	19
1954	266	262	91	77	35	8
1955	195	198	83	76	56	8
1956	204	177	97	127	36	13
1957	176	124	70	275	40	20
1958	174	121	47	88	24	7
1959	130	124	50	103	33	14
1960	177	158	66	97	28	11
1961	178	136	31	54	13	13
1962	136	123	47	94	17	21
1963	169	120	38	82	16	20
1964	180	122	30	195	9	27
1965	148	174	33	67	16	11
1966	138	191	38	75	17	19
1967	203	222	39	66	13	13
1968	116	174	47	81	15	15
1969	135	135	35	104	25	10
1970	83	140	30	120	17	16
1971	127	138	34	65	24	12
1972	192	116	35	92	31	13
1973	171	70	21	101	19	14
1974	132	52	24	72	20	12
1975	149	124	36	68	24	15
1976	112	214	45	69	21	6
1977	191	158	49	67	34	8
1978	269	143	46	94	38	12
1979	207	47	13	70	16	15
1980	251	40	13	37	18	26
1981	229	72	18	37	18	8
1982	179	55	11	25	7	8
1983	104	46	17	20	5	8
1984	109	51	10	26	4	6
1985	74	107	12	18	3	3
1986	93	111	15	31	5	2
1987	91	93	13	10	2	3
1988	97	48	9	150	2	5
1989	122	59	12	140	3	7
1990	80	77	12	42	3	6
1991	75	60	9	34	9	4
1992	115	39	8	39	7	8
1993	100	37	9	46	6	4
1994	124	35	9	38	5	-

Figure 14-C. Partial targeted CPUE for MHI bottomfish



Source: The partial targeted MHI CPUE is based on HDAR C-3 catch report data from commercial fishermen.

Calculation & Adjustment: The data used in Fig. 14-A were further screened to only include trips where at least 50% of the total catch by weight is the target species. This can only be done for species that are targeted successfully; incidental catch species will not contribute significantly enough to the overall catch. 95% non-parametric confidence intervals were calculated by bootstrapping.

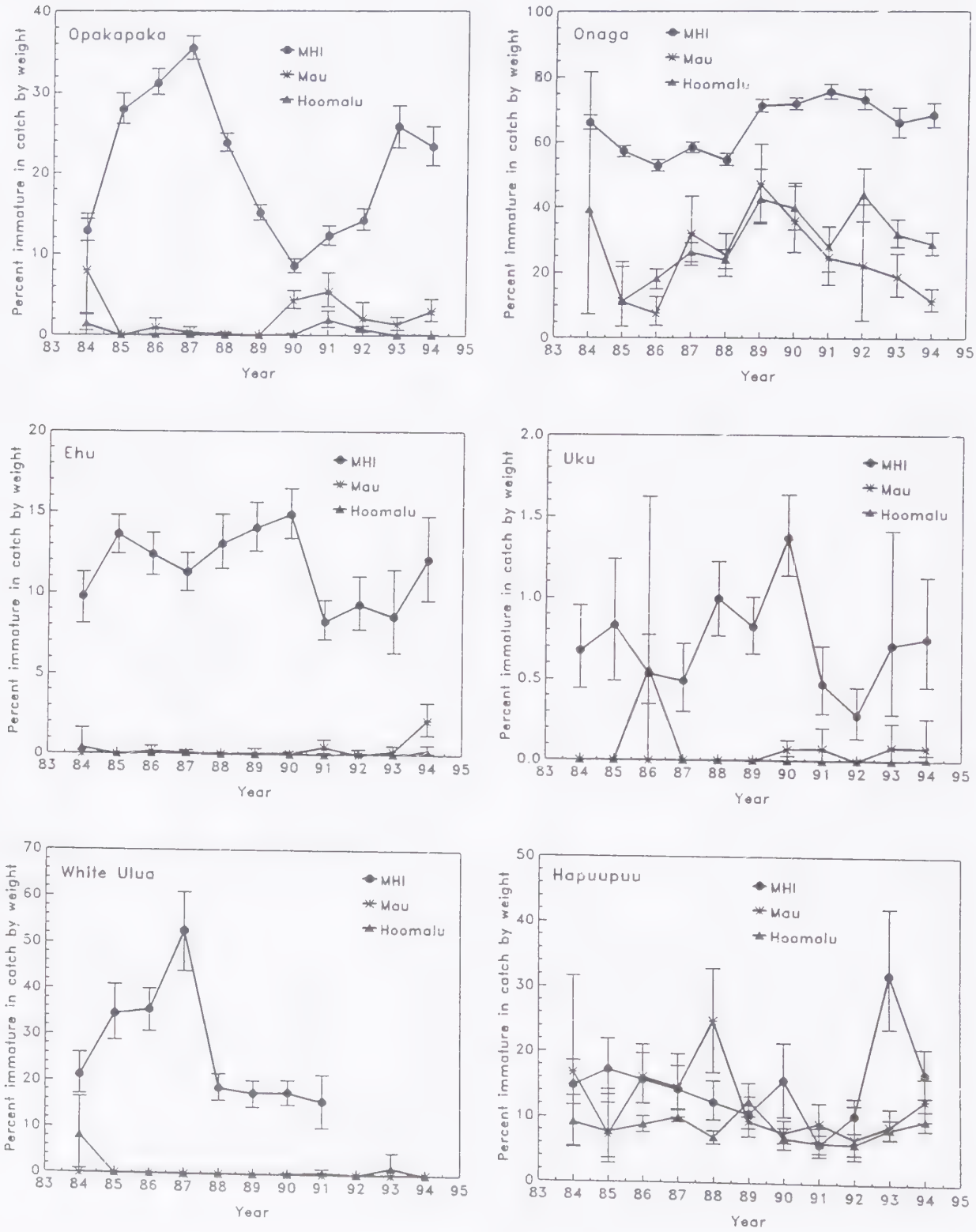
Comments: As in Fig. 14-B, there are apparent declines when comparing several recent years with values earlier in the time series. The decline is least apparent in opakapaka. The level of screening done here severely reduces the size of the sample, and this may contribute to some of the observed variability.

Interpretation: Comparison of CPUE values of the last 10 years (1984-94) with the first 10 years available (1948-57) indicate that all four species for which sufficient data is available have CPUE values less than 50% of original values. Opakapaka CPUE values are at 43% of original, onaga at 40%, ehu at 11% and uku at 34%. These values represent a yellow light condition for these four species, with the ehu stocks being the most stressed.

Figure 14-C data summary:

	MHI Targeted CPUE (lb/Trip)			
Year	Opakapaka	Onaga	Ehu	Uku
1948	277	496	581	705
1949	391	488	517	913
1950	385	566	564	701
1951	406	554	589	567
1952	348	442	380	779
1953	476	390	358	850
1954	779	552	224	1796
1955	458	547	222	869
1956	613	473	384	988
1957	496	479	327	1061
1958	344	382	257	745
1959	293	325	130	852
1960	507	364	242	939
1961	297	476	550	514
1962	216	379	677	806
1963	263	394	111	683
1964	320	475	120	1046
1965	281	411	275	574
1966	280	472	288	1014
1967	366	706	180	919
1968	215	484	415	525
1969	254	353	203	696
1970	191	345	161	600
1971	241	428	205	634
1972	339	420	171	699
1973	309	324	226	531
1974	225	236	152	488
1975	284	419	194	448
1976	293	421	112	846
1977	462	400	178	573
1978	501	389	92	640
1979	323	255	61	552
1980	430	415	79	235
1981	364	433	83	212
1982	293	252	58	164
1983	225	186	135	179
1984	212	173	72	241
1985	168	266	63	193
1986	194	267	58	418
1987	199	206	82	175
1988	198	192	60	549
1989	278	221	109	468
1990	187	205	82	260
1991	183	153	45	224
1992	212	154	27	238
1993	176	155	28	393
1994	208	144	39	316

Figure 15. Percent immature in Hawaiian bottomfish catch



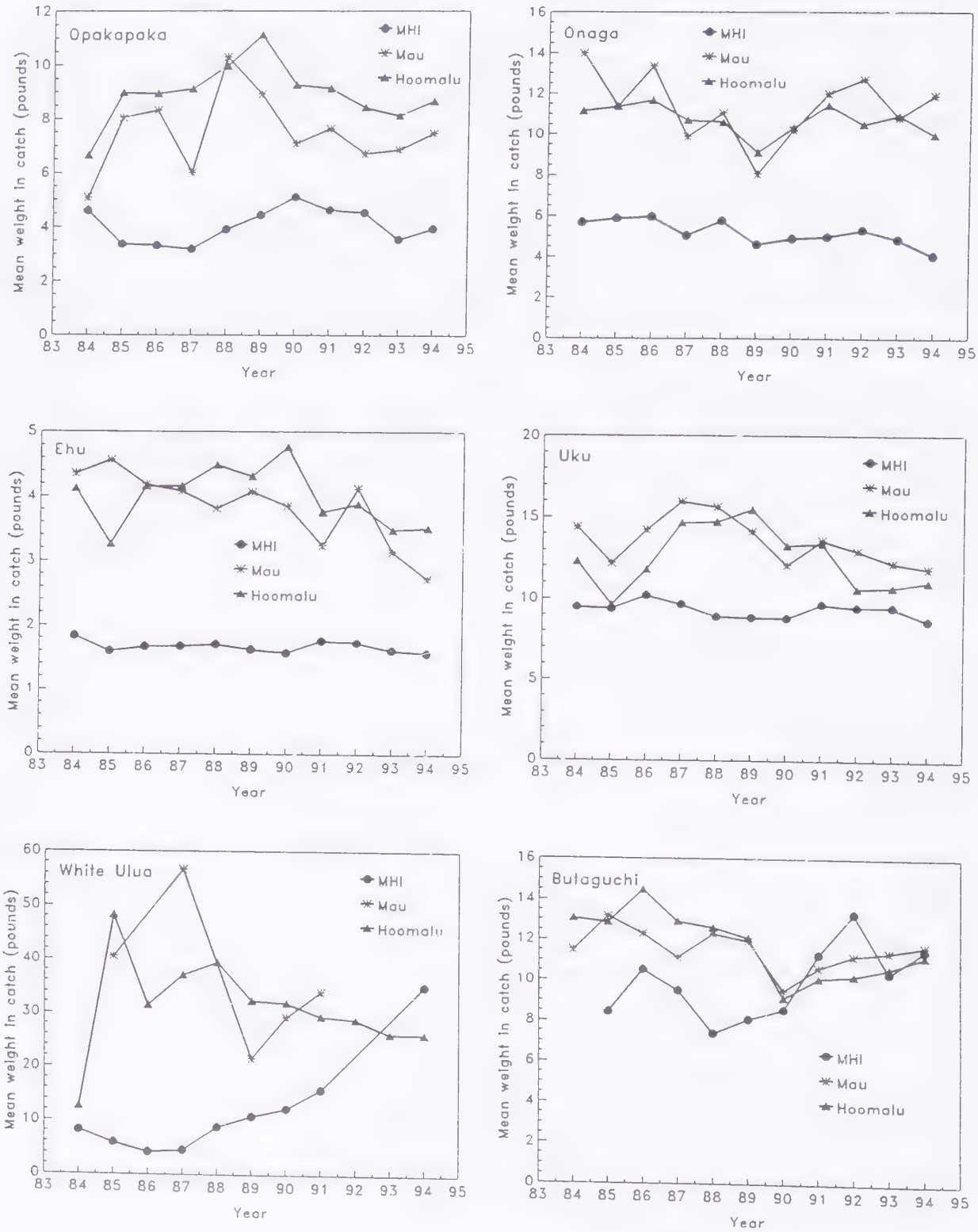
Source: Fish size data is derived from auction lot statistics obtained at the Honolulu UFA auction by HDAR, NMFS and WPRFMC personnel. Size at maturity from Everson (1984), Everson (1990 unpub. rep.), Everson et al. (1989), Kikkawa (1984), Sudekum et al. (1991).

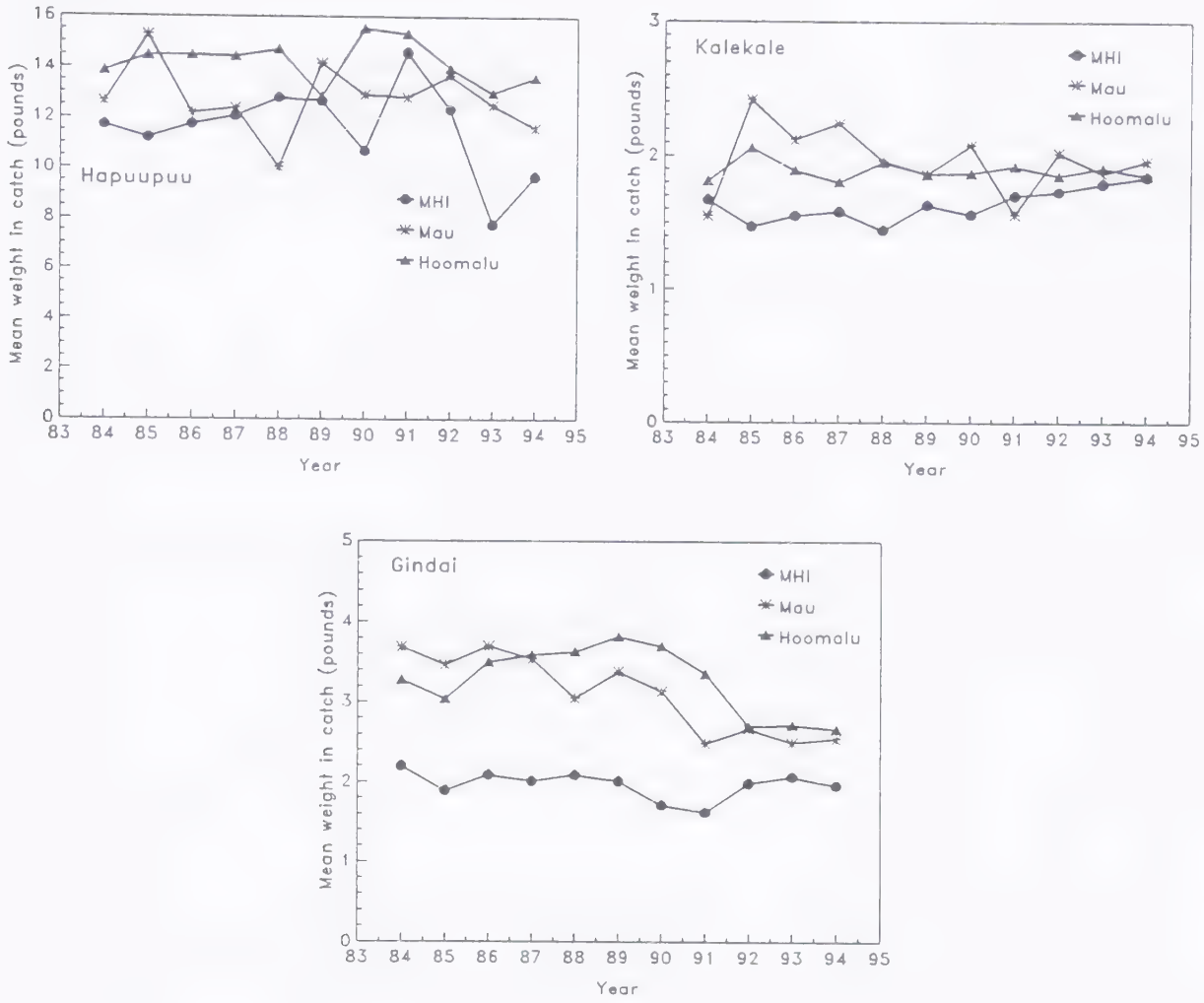
Calculation & Adjustment: The percent immature is calculated in terms of weight. The size distribution of sold fish is assumed to be representative of all fish caught. Maturity was assumed to be "knife-edge", and all fish in the same sales lot were assumed to be of equal size. 95% non-parametric confidence intervals were calculated by bootstrapping.

Comments: MHI catch is comprised of more immature fish than NWHI catch. In all areas onaga values are among the highest, though in recent years there appear to be gradual declines. Percent immature for uku are the lowest (i.e. healthiest) values in all zones. Among the other species, MHI opakapaka experienced periods of relatively high values (peaking in the years 1985-87), and has been increasing in recent years. MHI Hapuupuu declined from a significant increase in 1993 back to its normal range.

Interpretation: MHI onaga catch has the highest percentage of immature fish, and is the only one consistently over 50%, signifying a yellow light condition. The MHI hapuupuu value returned to its normal range after a sharp increase in 1993, and its mean weight, though less than prior years, is not drastically so. The 1994 value has returned to near pre-1993 levels.

Figure 16. Mean weight of Hawaiian bottomfish





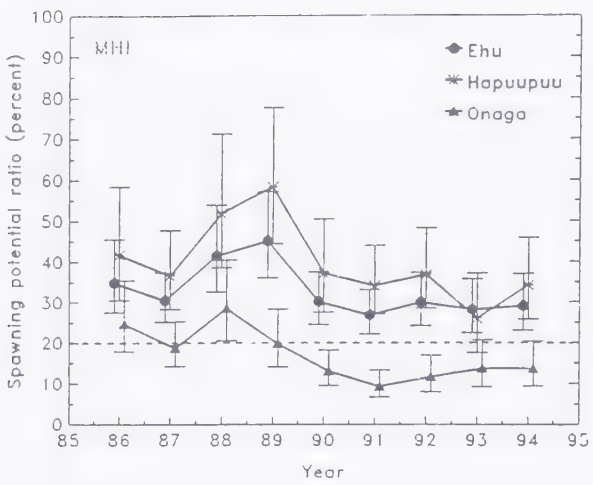
Source: Fish size data is derived from auction lot statistics obtained at the Honolulu UFA auction by HDAR, NMFS, and WPRFMC personnel.

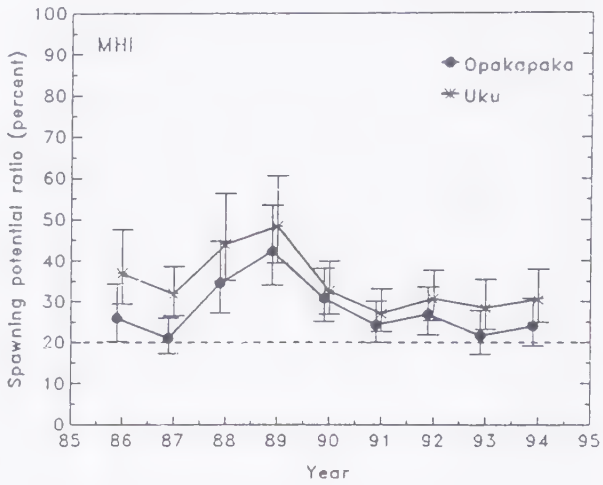
Calculation & Adjustment: The size distribution of sold fish is assumed to be representative of all fish caught. All fish in the same sales lot were assumed to be of equal size.

Comments: Mean weights of fish in the NWHI catch are generally larger than those in the MHI catch. Most 1994 values are similar to past values with no indication of continuously decreasing sizes.

Interpretation: The most notable change occurred in MHI hapuupuu; the cause for this decrease is unclear, yet it should be noted that the sample size for MHI hapuupuu is very small as this species only comprises approximately 2.5% by weight of the 1994 MHI bottomfish catches.

Figure 17. Spawning potential ratio (SPR) for MHI bottomfish





	SPR (%)				
Year	Ehu	Hapuupuu	Onaga	Opakapaka	Uku
1986	35	42	25	26	37
1987	31	37	19	21	32
1988	42	52	29	35	44
1989	45	58	20	42	48
1990	30	37	13	31	33
1991	27	34	9	24	27
1992	30	37	12	27	31
1993	28	26	14	22	29
1994	29	34	14	24	31

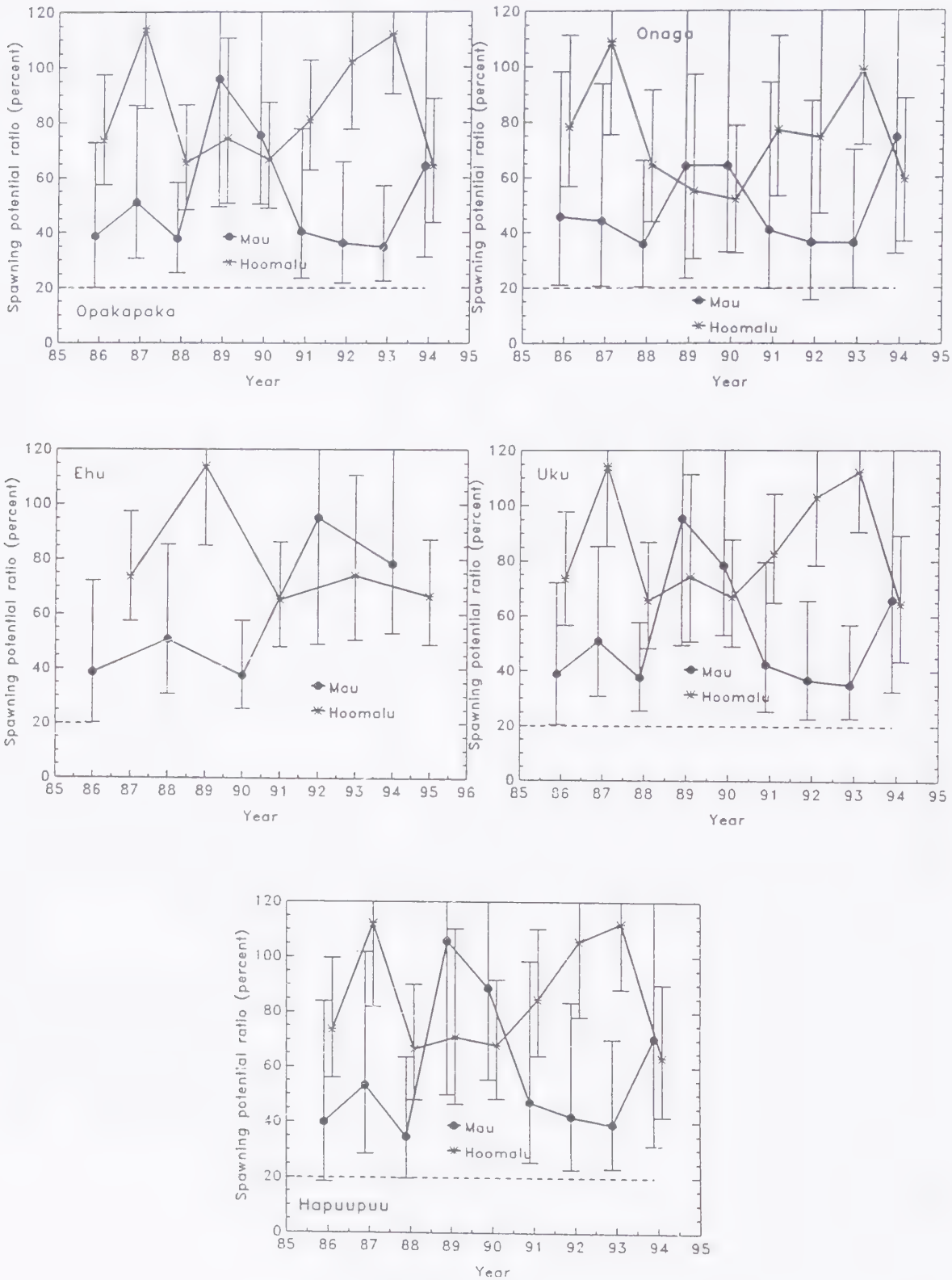
Source: SPR estimated from the Honolulu UFA auction size frequency data collected by HDAR, NMFS, and WPRFMC personnel; CPUE estimates from C-3 form data reported to HDAR by commercial fishermen. Additional information for opakapaka obtained from size frequency data of fish caught from the R/V Townsend Cromwell.

Calculation & Adjustment: Calculations use similar methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Virgin CPUE estimate is 1948-1952 mean; current CPUE estimate is a single year estimate. CPUE is of aggregate bottomfish from the areas of Maui, Lanai, Molokai, and Penguin Banks (see Fig. 14-A for more details). Virgin catch size composition is estimated from the 1986-1988 NWHI catch data, and current catch size composition is estimated from single year MHI catch data. All SPR values changed slightly from previous year's reports due to improvements in the calculations. The 95% non-parametric confidence intervals were constructed based on "best" and "worst" case bounds of SPR components (CPUE and percent immature).

Comments: Current SPR estimates for four of the five species are above the twenty percent critical level used as an indicator of recruitment overfishing. Onaga remains below 0.20. Hapuupuu and uku SPR values remain consistently the highest.

Interpretation: The peak SPR values observed in 1988-1989 for all species were largely a response to increases in aggregate CPUE due to increased uku landings. Onaga SPR values indicate a red light situation for this species. Values for other MHI species have not been below the 20% threshold, but have occasionally been close and the lower confidence limits have dipped below this level on occasion.

Figure 18. Spawning potential ratio (SPR) for NWHI bottomfish



Source: SPR estimated from Honolulu auction size frequency data collected by NMFS personnel, and CPUE estimates from C-3 form data reported to HDAR by commercial fishermen.

Calculation & Adjustment: Calculations use same methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Virgin CPUE estimate is 1948-52 mean; current CPUE estimate is a single year estimate. CPUE is of aggregate bottomfish calculated separately for Mau and Hoomalu Zones. Virgin catch size composition is estimated from the 1986-88 NWHI catch data, and current catch size composition is estimated from single year catch data. All SPR values changed slightly from previous year's reports due to improvements in the calculations. 95% non-parametric confidence intervals were constructed based on "best" and "worst" case bounds of SPR components (CPUE and percent immature).

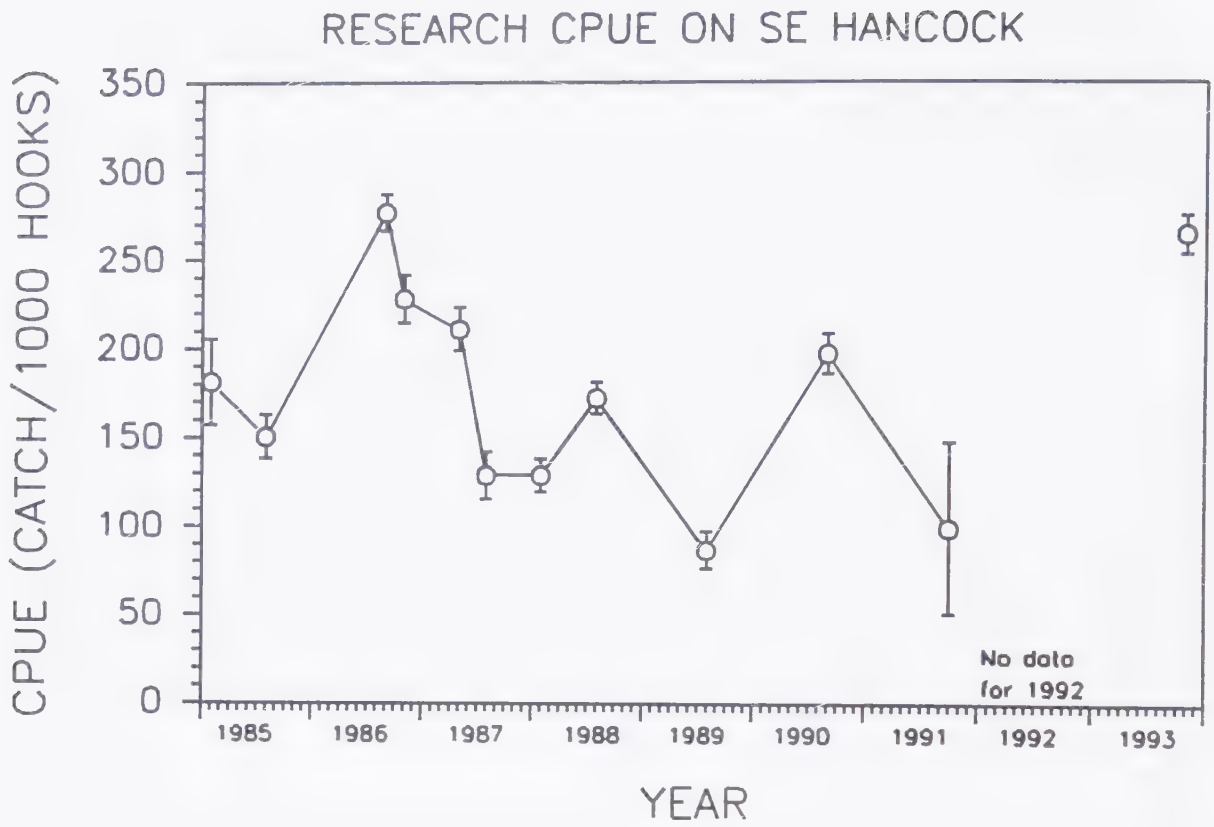
Comments: Current SPR estimates for all five species in both zones are above the 0.20 critical level used as an indicator of recruitment overfishing though lower confidence limits often are near or slightly below this level. Mau Zone SPR estimates tend to be slightly lower than Hoomalu Zone SPR estimates for most species, and onaga SPR estimates tend to be slightly lower than those for most other species.

Interpretation: The correlation of SPR values among species is due the high dependence of SPR on the CPUE component, given that the maturity component is nearly negligible. All species utilize the same aggregate bottomfish CPUE component. The maturity component is small relative to MHI SPR calculations because 1) the NWHI catch is primarily mature fish, and 2) the current catch size composition is relatively unchanged from the best estimate of the virgin catch size composition.

SPR (%)

Year	Ehu	Hapuupuu	Onaga	Opakapaka	Uku
Mau Zone					
1986	39	40	46	39	39
1987	51	53	44	51	51
1988	38	35	36	38	38
1989	95	106	64	96	95
1990	78	89	64	75	78
1991	42	47	41	40	42
1992	37	42	36	36	37
1993	35	39	36	35	35
1994	65	71	75	64	65
Hoomalu Zone					
1986	74	74	78	74	74
1987	114	112	109	114	114
1988	66	67	65	66	66
1989	74	71	55	74	74
1990	67	68	52	67	67
1991	83	85	77	81	83
1992	103	106	75	102	103
1993	112	112	99	112	112
1994	64	64	59	64	64

FIGURE 19



DATA SOURCE:

Figure 19 presents CPUE based on research longline catches at SE Hancock Seamount by NMFS, Honolulu personnel aboard NOAA ship R/V Townsend Cromwell. Vertical bars represent the 95% confidence intervals about the mean CPUE. The CPUE derived from the September 1991 stock assessment survey was computed using data from only the first 5 bottom longline sets as opposed to the standard 40 sets used on all other research surveys. The armorhead population at SE Hancock Seamount was not assessed in 1992 and 1994 and therefore no current CPUE estimates are available. The latest stock assessment survey for armorhead at SE Hancock Seamount was conducted in October 1993. Future NMFS armorhead stock assessment cruises to SE Hancock Seamount are unlikely. Henceforth, annual armorhead SPR values for Colahan Seamount (located outside the U.S. EEZ) will be provided to serve as a relative indicator of armorhead stock levels at the Hancock Seamounts

(see explanation in Calculations & Adjustments subsection of ARMORHEAD SPAWNING POTENTIAL RATIO section).

CALCULATIONS & ADJUSTMENTS:

Fishing gear and sampling methods utilized during armorhead stock assessment surveys at SE Hancock Seamount are described in Somerton and Kikkawa (1992; Fishery Bulletin, U.S. 90:756-769). The seamount is divided into quadrants and effort is portioned equally among quadrants. Within each quadrant, effort is conducted over four depth strata (<265 meters (m), 265-300 m, 301-400 m, and 401-500 m). CPUE is calculated as a depth stratified average. Based on gear comparison studies of fishing droppers with and without hook timers conducted on the August 1990 survey, new coefficients accounting for the negative effects of hook timers were computed and applied to the catches obtained on all SE Hancock research surveys since 1985.

INTERPRETATION:

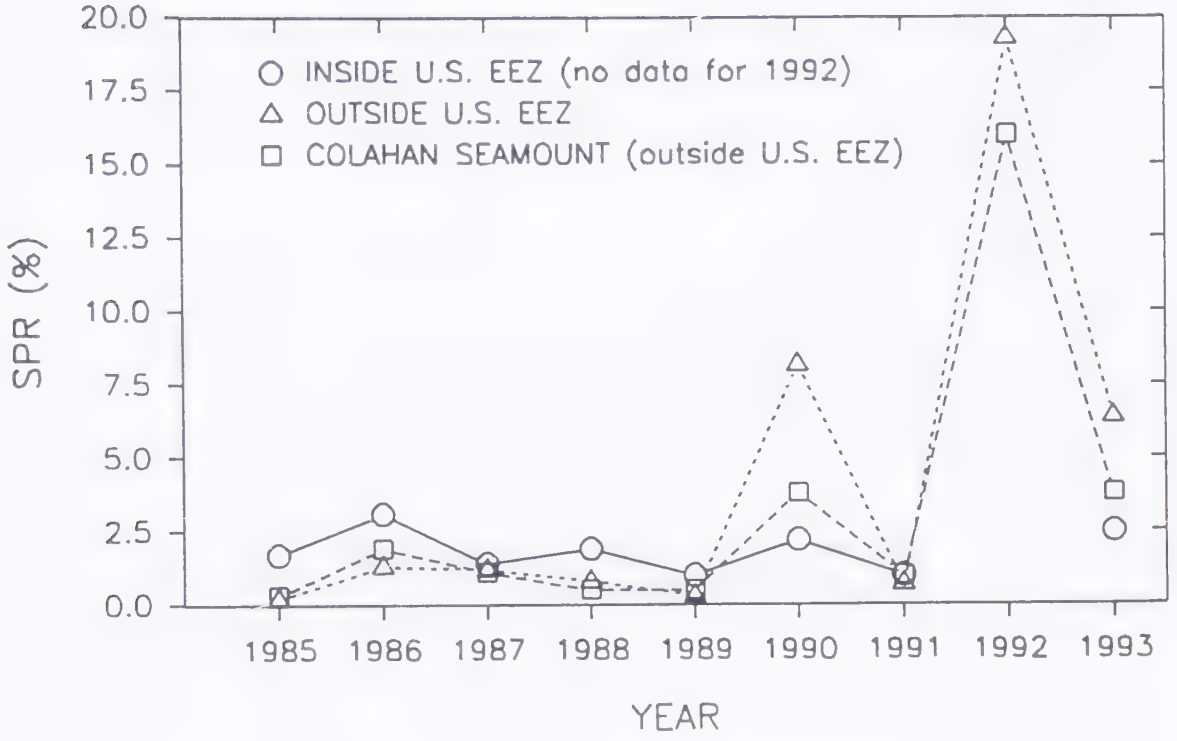
The fluctuations in CPUE shown in Figure 19 are apparently the result of episodic recruitment followed by high natural mortality. These peaks in CPUE correspond to years (1986 and 1990) where an appreciable proportion (at least one-third) of the armorhead population consisted of fat individuals (fatness index $\geq$0.26) considered new recruits to the seamount population. Fatness index is defined as body depth divided by fork length. Subsequent to recruitment individuals cease somatic growth and over the course of 3-4 years, survivors decline in fatness index and weight. Without subsequent recruitment to the population in succeeding years, the armorhead population as a whole would decline both in numbers (natural mortality) and in biomass (declining fatness index). The high 1993 CPUE is unusual, however, since fat individuals (new recruits) account for <15% of the 1993 population while leaner individuals (<0.23 in fatness index) form the bulk of the population. These results apparently indicate that the 1993 population is primarily derived from recruitment which occurred either in late 1991 or during 1992. Previous work indicates that little if any annual recruitment to SE Hancock Seamount occurs after the summer months (Humphrey et al. 1993; Fishery Bulletin, U.S. 91:455-463). Since the 1991 stock assessment survey coincided with the end of the summer season, the increase in CPUE at SE Hancock for 1993 is most likely due to good recruitment during 1992. The sharp increase in the 1992 CPUE among Seamounts outside the U.S. EEZ implies that a high recruitment occurred (across all Seamounts) in 1992.

TABULATED VALUES:

MONTH/YEAR	ARMORHEAD CPUE
JAN 1985	181.28
JUN 1985	150.51
AUG 1986	276.80
OCT 1986	228.03
APR 1987	210.98
AUG 1987	128.73
JAN 1988	128.77
JUL 1988	172.14
JUL 1989	86.69
AUG 1990	197.08
SEP 1991	98.97
1992	(unknown)
OCT 1993	264.85
1994	(unknown)

ARMORHEAD SPAWNING POTENTIAL RATIO

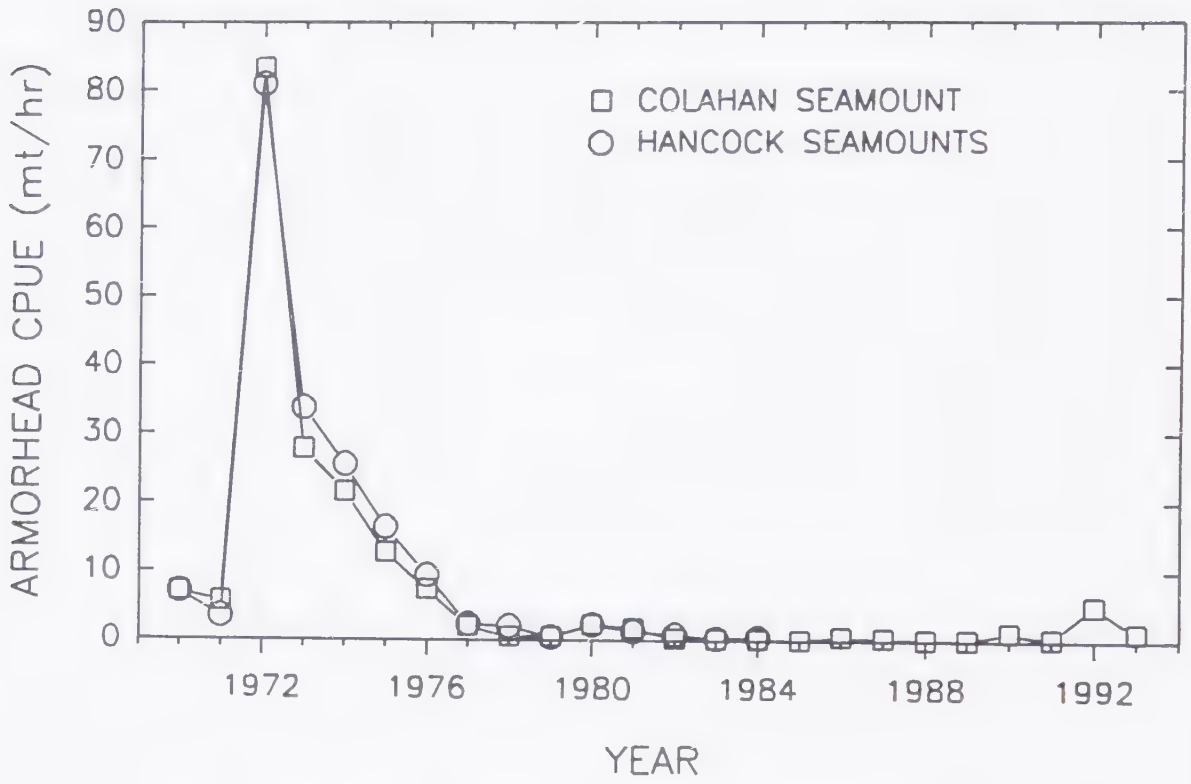
FIGURE 20



DATA SOURCE:

SPR values for Seamounts outside the U.S. EEZ are based on reported catch and effort data from the Japanese trawler fleet and values for Seamounts within the U.S. EEZ (Hancock Seamounts) are based on research longline CPUE in addition to the trawl CPUE. However, with the cessation of research longline cruises to the Hancock Seamounts, SPR values for Colahan Seamount (comparable in size and located closest to the Hancock among Seamounts outside the U.S. EEZ) are being provided now and in the future as an indicator of stock levels at the Hancock Seamounts. SPR values for Colahan Seamount are also based on reported catch and effort data at that seamount by the Japanese trawler fleet.

FIGURE 21



CALCULATIONS & ADJUSTMENTS:

SPR values outside the U.S. EEZ are computed as the current year CPUE divided by the average CPUE during the first three years of the fishery (1970-1972). SPR values inside the U.S. EEZ are computed as the estimated biomass on SE Hancock Seamount divided by the 1970-1972 average biomass. Biomasses are estimated using procedures described in Somerton and Kikkawa (1992). The SPR values for Colahan Seamount are computed as the current year CPUE divided by the average CPUE during the first three years of the fishery (1970-1972) at Colahan Seamount (Figure 20).

The decision to use SPR values for Colahan Seamount (instead of the overall outside U.S. EEZ values) as an indicator of armorhead stock conditions inside the U.S. EEZ (i.e., Hancock Seamounts) is based on the greater similarities between these seamounts. Aside from Colahan Seamount, the seamounts fished for armorhead outside the U.S. EEZ are Milwaukee

Seamounts and Koko Seamount. These latter seamounts have summit areas of 67 and 564 nm^2 and average summit depths of 190 and 170 fm, respectively, while Colahan and the Hancock Seamounts have much smaller summit areas (about 1.4 nm^2) and shallower summit depths (141-150 fm). Fishing effort by the Japan trawl fleet has historically been different at these two types of seamounts. Koko and Milwaukee Seamounts have always received the majority (about two-thirds) of the annual total trawling effort and were typically fished intensively over a sustained period of time. However, the fishing effort at Colahan and the Hancock Seamounts was applied in pulses since catch levels could not be sustained for more than several days without a "cooling off" period. These similarities plus the historical close coincidence between Colahan and Hancock Seamounts in temporal profiles of armorhead CPUE from the Japan trawl fleet (Figure H-20) indicate that SPR values for Colahan Seamount should provide the best future indicator of armorhead stock levels at the Hancock Seamounts.

INTERPRETATION:

SPR within the region outside of the U.S. EEZ, which historically (Japan trawl fleet during the 1969-1981 period) contributed 91% of the total catch of armorhead, is 6.4%; based on the most current (1993) available catch and effort statistics from the Japan North Pacific trawl fishery. This indicates a sharp decline in stock levels from the previous year's dramatic increase of SPR levels outside the U.S. EEZ. This result corroborates research findings reported last year by Japanese colleagues of low catch rates and low recruitment encountered during a survey conducted in October 1993. Fishing effort in 1993 had increased some 50% over 1992 and monthly catch rates abruptly declined by mid-1993. This sharp decline outside the U.S. EEZ is interpreted to be a result of sustained intensive effort on the high 1992 recruitment stock coupled with little recruitment in 1993 to compensate for losses due to fishing and natural mortality. Based on previous trends, catch levels are expected to decline further in 1994 unless offset by an increase in recruitment.

Based on current estimates of a 2-2.5 year pelagic phase prior to seamount recruitment, the 1992 recruitment would have originated from the 1989-1990 winter spawning season. If this is correct, then the large 1992 recruitment originated from a parental stock which in 1989 had the lowest SPR values both inside and outside the U.S. EEZ (see table next page). This would appear to support the notion that dramatic increases in armorhead abundance across the seamounts are episodic and the product of environmental factors rather than simply a stock-recruitment relationship.

A Japan research trawl survey of the seamounts outside the U.S. EEZ is planned for August 1995. Results of this survey, particularly at Colahan Seamount, should provide a more current indication of relative stock levels at the Hancock Seamounts.

TABULATED VALUES:

ARMORHEAD SPR (%)

YEAR	INSIDE US EEZ	COLAHAN	OUTSIDE US EEZ
1985	1.7	0.3	0.2
1986	3.1	1.9	1.3
1987	1.4	1.1	1.2
1988	1.9	0.5	0.8
1989	1.0	0.5	0.3
1990	2.2	3.8	8.2
1991	1.0	1.0	0.7
1992	NA	16.0	19.3
1993	2.5	3.8	6.4
1994	NA	NA	NA

Appendix 4

Northern Mariana Islands

Introduction

The Northern Mariana Islands (NHI) bottomfish fishery occurs primarily around the islands of Saipan, Tinian, Rota, Farallon de Mendilla, Anatahan and Aguigan. However, this discussion will be limited to the catches landed on Saipan which is by far the largest market. The fishery will be characterized by data collected through the Commercial Purchase Data Base which indirectly records actual landings by recording all local fish sales to commercial establishments. This data collection system is dependent upon first-level purchasers of local fresh fish to accurately record all fish purchases by species categories on specially designed invoices. Division of Fish and Wildlife (DFW) staff routinely collect and distribute invoice books to more than 60 participating local fish purchasers; which include practically all fish markets, stores, restaurants, hotels and roadside vendors (fish-mobiles). This data collection system was extended to Rota and Tinian in May 1993. Commercial Purchase data receipt forms for these two islands have been collected and are included in this year's report. Although this data collection system has been in operation since the mid-1970s, only data collected since 1983 are considered accurate enough to be comparable for most aspects of the fisheries.

The NMI's bottomfish fishery consists primarily of small-scale local boats engaged in commercial and subsistence fishing. Deepwater (>500 ft) fishing, targeting onaga and other prized snappers, are largely commercial, whereas, those targeting shallow water (100-500 ft) species, such as the emperors, can also be subsistence. It is assumed that hand lines, home fabricated hand reels and electric reels are the common gear utilized for the bottomfish fishery. Historically, some trips lasted more than one day, currently however, effort is defined and calculated on a daily trip basis Fishing trips are generally restricted to daylight hours, with all vessels returning before or soon after sunset. The bottomfish fleet, in terms of participation, consists primarily of vessels less than 24 feet in length and are usually limited to a 20-mile radius from Saipan. The larger vessels that are able to fish extended trips, sometimes traveling as far as Pagan, have landed most of the bottomfish that were reported through the purchase receipt form. In 1994, two major bottomfish operators went into operation, in which a large volume of onaga (*Etelis coruscans*) and giant grouper (*Epinephelus octofasciatus*) were being harvested.

The shrimp (Caridean) were also being landed in 1994. A single-full time offshore shrimping operation began during the early part of the year. The operation usually last about a day with a CPUE per line of 24 hours. Average weight is about 400 pounds per trip.

Bottomfishing commands more skill than pelagic trolling and requires knowledge of the location of specific submerged bottom features and hooking techniques. Presently, bottomfish fishing can still be described as "hit or miss" for most of the smaller size (14-25 ft.) vessels. Without fathometers and even nautical charts, the majority of fisherman utilizing small size vessels fish randomly, many times relying on land features for guidance to a fishing area. This type of

fishing is very inefficient and usually results in a low CPUE when compared with pelagic trolling. With the larger size (25 ft. and above) vessels, bottomfishing is different in that most highliner operators utilize Global Positioning System (GPS), fathometers and electric reels.

Summary

Bottomfishing in the NMI has somewhat improved from its previous decline, and it has continued to show recovery by its sign of increased landings. This improvement in "growth" in the fishery is evidenced by the 37% increased over 1993 landing and 149% increased over 1992. Domestic US, joint-venture, and foreign vessels are still continuing their inquiry about full-time bottomfishing throughout much of the NMI. The impact to the commercial market is still unknown, but a fish market assessment study has been recently conducted and its report will be published soon. During 1992, charterboat activities and their impact on the local fisheries market were also investigated. A system of collecting CPUE data (shallow bottom) for the charter boat catches had been implemented and statistics were collected regularly. A draft report of this study was just completed and the final report will soon be made available.

The total number of bottomfishing operations and trips to islands north of Saipan, where bottomfish are more abundant, has been increasing in recent years.

Revenues and prices will most likely continue to increase with renewed fishing interest and increased utilization of modern electronics and equipment. Deepwater snappers still command the best prices. Fishermen utilizing larger vessels will have greater access to these fish; the market for them will improve as the supplies of these fish are now more consistent and fish quality are well handled. With a proper training program in bottomfishing, that addresses proper fish handling, fathometers and nautical charts, use of modern electronic equipment, such as GPS, fish finders, electric reels, anchoring techniques and marketing, this industry should grow dramatically.

With the planned expansion of biological data collection from the bottomfish fishery, an assessment can be completed for the bottomfish stocks surrounding Saipan. After identifying the extent of resource utilization, additional data collecting could be used to help determine management strategies.

Recommendations

1) Hire a full time staff person to specifically monitor, assess and analyze bottomfish being landed, specifically those that are harvested from the Northern Islands.

2) Establish baseline (virgin stock) parameters (CPUE, percent immature) for the Guam/Northern Marianas deep-water bottomfish complex (e.g., survey on red-gilled emperor) utilizing data collected during Resource Assessment Investigation of the Marianas Archipelago (RAIOMA) cruises (1981-1984), to help calculate SPR, with assistance from NMFS.

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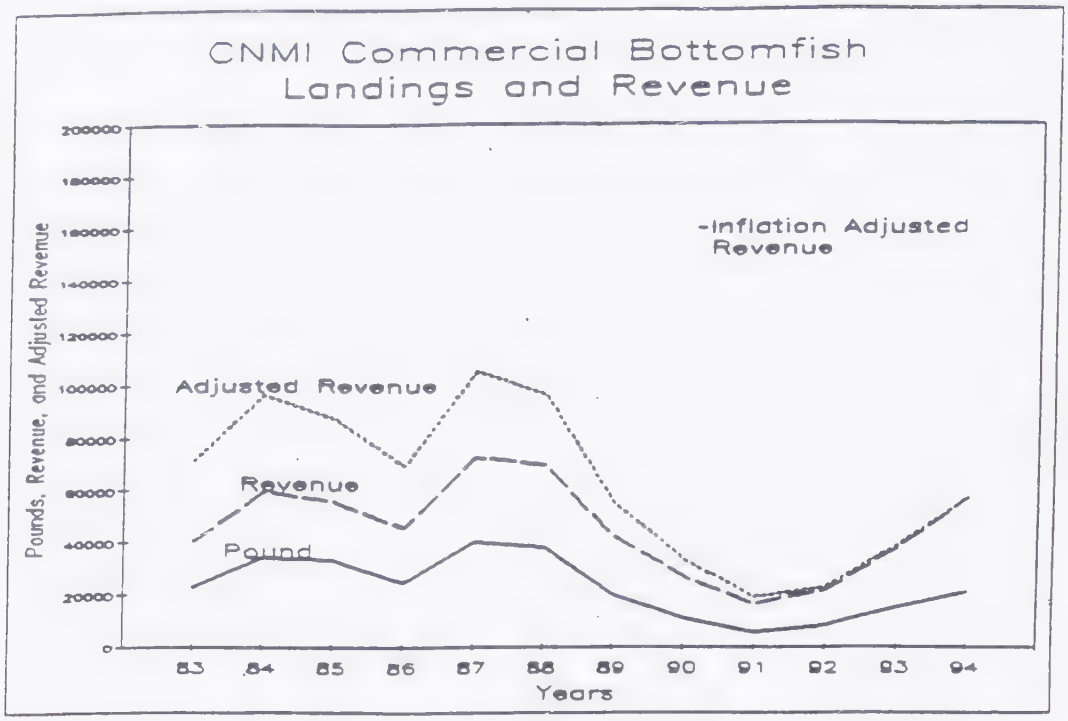
6. NMI bottomfish catch in average pounds per trip 4-13

Figure 1. NMI commercial bottomfish landings and revenue



YEAR	Pounds	Revenue	Adjusted Revenue
1983	22683	40003	70805
1984	33924	59005	96178
1985	32780	55396	86972
1986	23929	45079	68971
1987	39772	71868	104927
1988	37850	69052	95982
1989	19550	41379	54206
1990	10903	26323	32904
1991	5693	16118	18697
1992	8148	21032	22504
1993	14769	37241	38429
1994	20363	56405	56405

Calculation: Landings in pounds are from a simple data base summation of reported purchases of all bottomfish species combined. Revenue in dollars is from the same type of data base summation of the value field. The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 1994 CPI figure as the basis by which calculations of previous years' prices are made.

Interpretation: Landings, revenues and adjusted revenues for 1994 have increased over 1993. The increase is attributed to the increase in Bottomfishing operation (Fig. 3), particularly with new ventures that operated full time 1994.

Table 1. NMI 1994 commercial landings of bottomfish species

Species	Pounds	Revenue	$/lb
Bottomfish*	10401	26564	2.36
Jacks	935	2209	2.36
Gindai	46	117	2.54
Grouper	3162	7743	2.45
Onaga	3662	14741	4.02
Opakapaka	659	1645	2.50
Emperor	1496	3384	2.26
Total	20363	56405	2.77

* denotes miscellaneous or non-identified species.

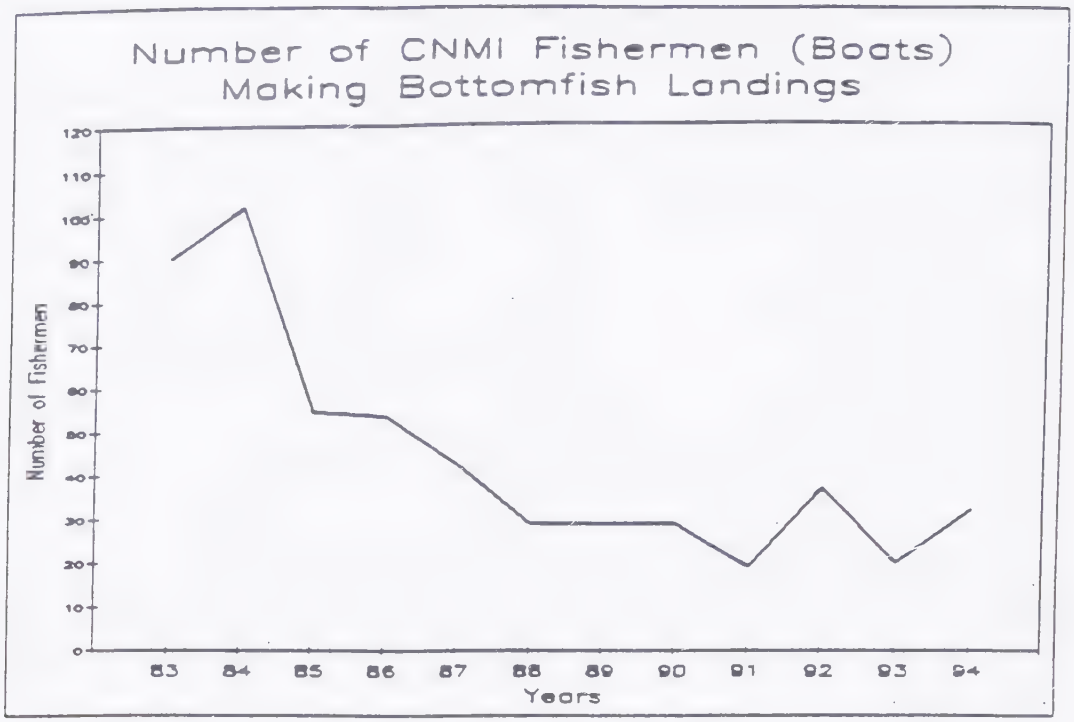
Calculation: Annual summaries for each species from invoice data sheets.
(Note: During 1994, the number of vendors increased along with the collection effort. There are about 38 participating local bottomfish fishermen (boats) compared to the approximate 20 that were recorded during 1993.)

Interpretation: Unfortunately, 51% of all 1994 bottomfish landings were not identified by species groups and any interpretations based on the above data would be questionable. Follow-up inquiry with vendors of this concern revealed that emperor species were predominant among these recorded bottomfishes.

The deepwater bottomfish, onaga, commanded the higher prices per pound, while prices for shallower-water bottomfish (groupers and emperors) ranged from $1.57 to $1.76 per pound less.

The low average price per pound of $2.77 is primarily due to highliners selling their catch of bottomfish at wholesale price to various participating vendors.

Figure 2. Number of Fishermen (boats) making bottomfish landings



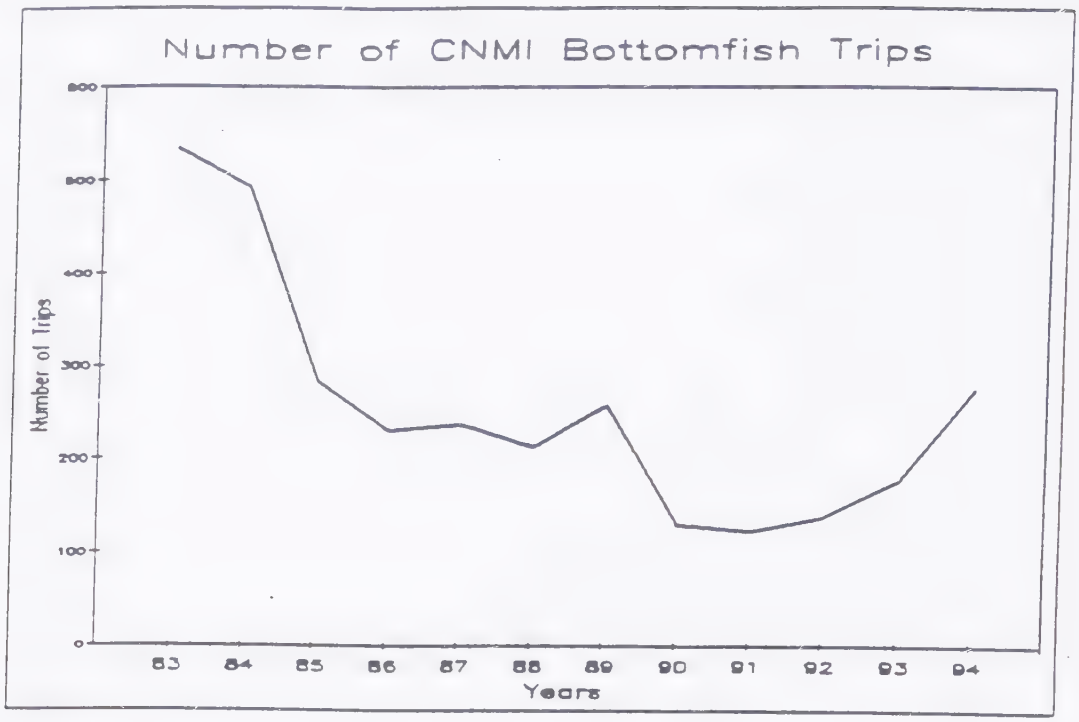
Year	Number of Boats
1983	90
1984	102
1985	55
1986	54
1987	42
1988	29
1989	29
1990	29
1991	20
1992	38
1993	20
1994	32

Calculation: The fisherman or boat selling the catch is identified on the "trip ticket" invoices used by purchasers. The plot shows the number of unique fishermen making any landings of bottomfish within a given year.

Interpretation: As with the number of trips (Fig. 3), the number of boats or fishermen making commercial landings of any bottomfish species declined from 1984 to 1988, stabilized between 1988-90, slightly increased during 1992, then decreased again in 1993 and then increased during 1994.

Although bottomfishing is showing an increase in the number of boats selling the catch in 1994, the number of larger (50' plus) vessels (responsible for more than 65% of the catches) fishing regularly also increased.

Figure 3. Number of NMI bottomfish trips

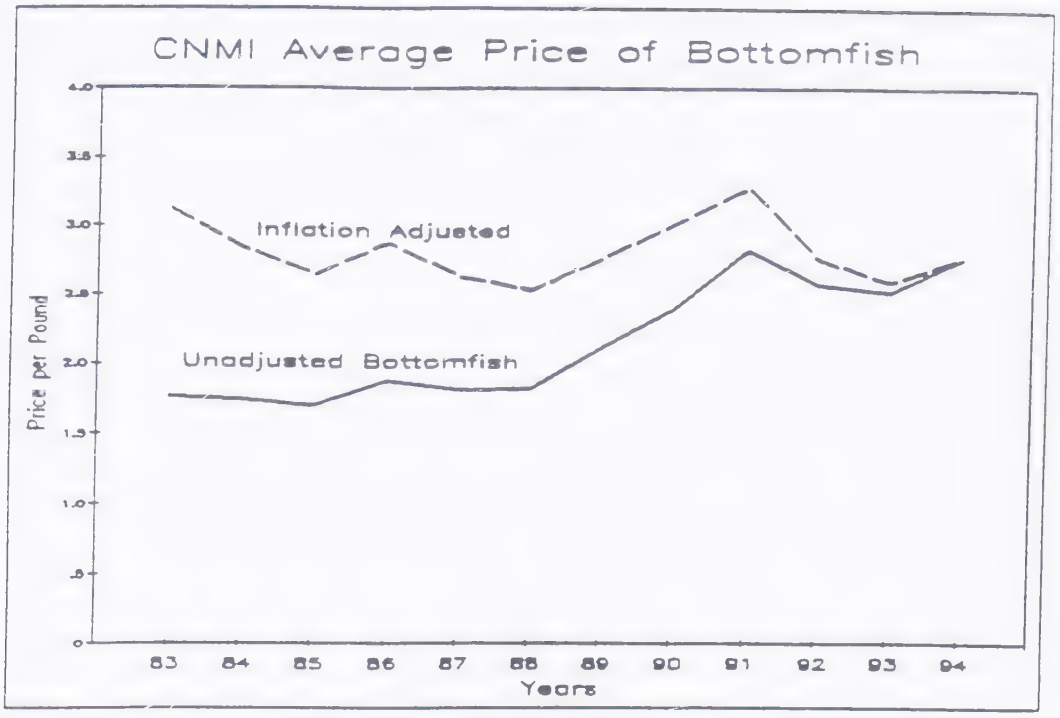


Year	Trips
1983	533
1984	492
1985	283
1986	229
1987	237
1988	211
1989	257
1990	129
1991	124
1992	140
1993	178
1994	275

Calculation: The number of trips which resulted in landing any bottomfish are tallied by adding each recorded fisherman's trip on a given day. The assumptions are that each fisherman lands only once in a given day, and that he sells all of his catch on that day. Most trips last a single day, but it is also known that the occurrence of longer fishing trips is increasing.

Interpretation: The increase that occurred in number of bottomfishing trips being taken by the NMI fleet is happening because there are now more full time operations conducting regularly scheduled long trips to the northern islands, where bottomfish are more abundant.

Figure 4. NMI average price of bottomfish



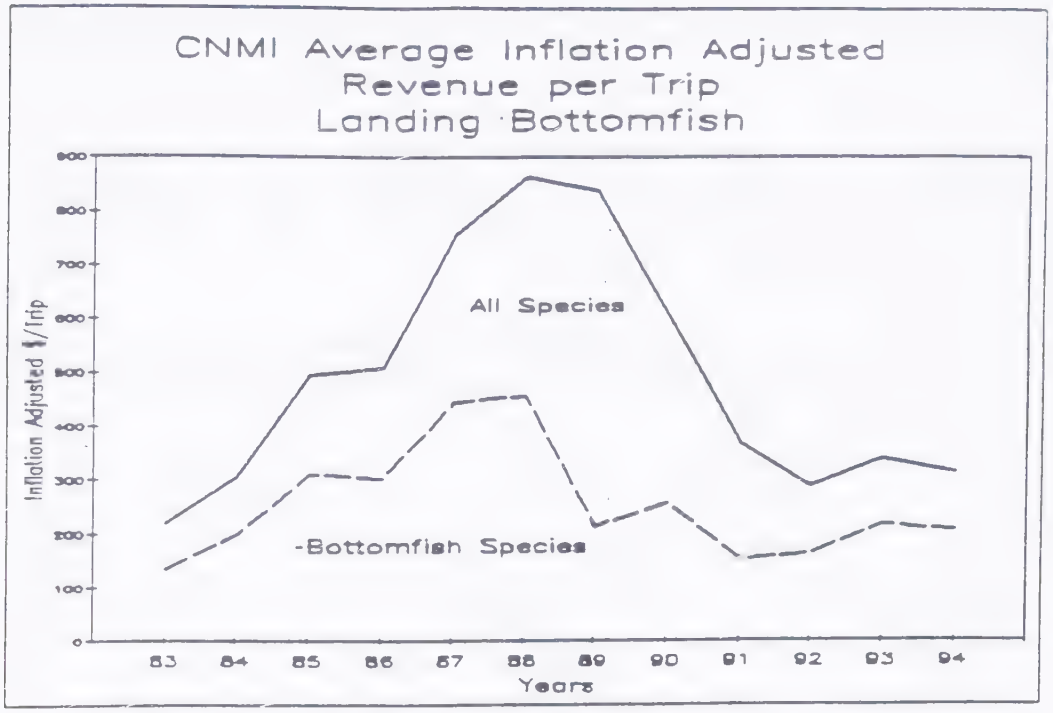
Year	Unadjusted $/lbs.	Adjusted $/lbs.
1983	1.76	3.12
1984	1.74	2.84
1985	1.69	2.65
1986	1.88	2.88
1987	1.81	2.64
1988	1.82	2.54
1989	2.12	2.77
1990	2.41	3.02
1991	2.83	3.28
1992	2.58	2.76
1993	2.53	2.60
1994	2.77	2.77

Calculation: The average price of the bottomfish complex is calculated by dividing the total revenue by the total landings.

The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 1994 CPI figure as the basis by which calculations of previous years' prices are made. The CPIs for 1983-87 were not available from the appropriate NMI agency and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 NMI CPI.

Interpretation: The average price increased steadily from 1988 to 1991, where it reached a record high of $2.83. In 1994, the price increased to $2.77 from the $2.53 of 1993 due to the large volume of bottomfish being sold to more than one establishment as was the case in 1993. Re-sold catches are not included in this report.

Figure 5. NMI average inflation adjusted revenue per trip landing bottomfish



	Bottomfish Species		All Species	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted
1983	75	133	124	219
1984	120	196	186	303
1985	196	308	314	493
1986	197	301	330	505
1987	303	442	517	755
1988	327	455	621	863
1989	161	211	639	837
1990	204	255	485	606
1991	130	151	316	367
1992	150	161	268	287
1993	210	216	329	339
1994	205	205	313	313

Calculation: Only trips which landed bottomfish are included in these calculations. "Bottomfish $/Trip" is the total revenue of the bottomfish sold from a trip, and "All Species $/Trip" is the total trip revenue of all species combined (e.g. any pelagic and reef fish which were sold).

The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 1994 CPI figure as the basis by which calculations of previous years' prices are made. The CPIs for

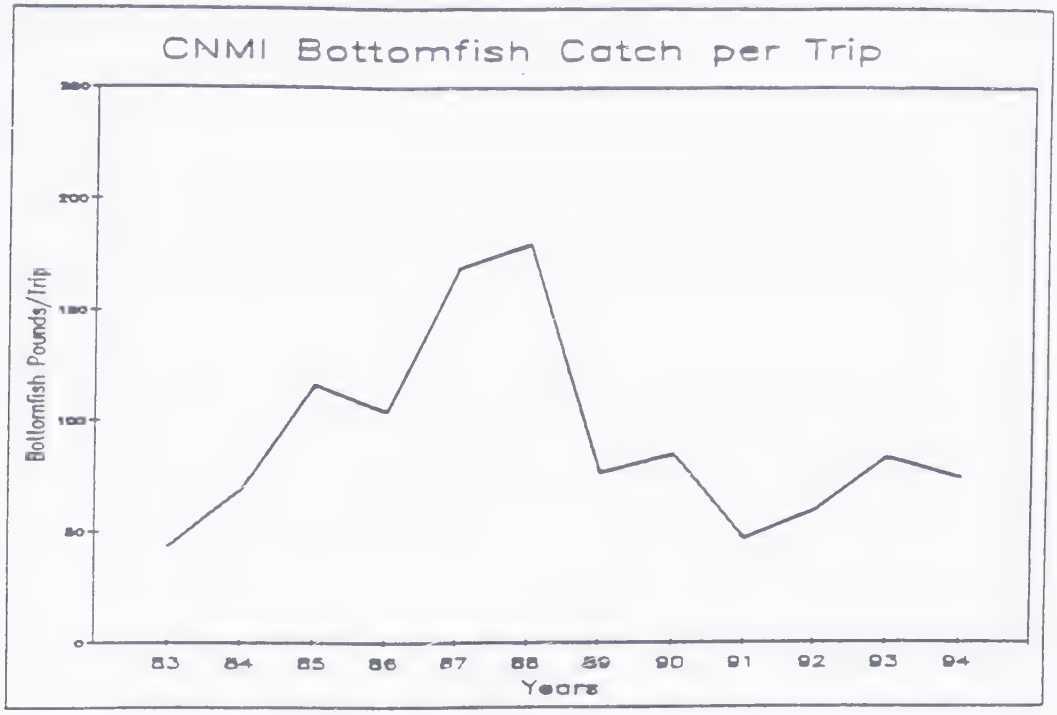
1983-87 were not available from the appropriate NMI agency and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 NMI CPI.

Interpretation: In general, inflation adjusted bottomfish revenue is making a slight decrease in 1994, after experiencing a slight increase in 1993. The all species inflation adjusted revenue, which had been declining since 1988, appears to have not stabilized at this point.

The actual difference in price for inflation adjusted bottomfish revenue decreased when compared with 1993. Inflation adjusted for all species revenue also decreased in 1994. Demand for bottomfish entering the market remained constant with previous year's, despite the increase of high priced onaga and opakapaka.

The bottomfish fishery has always been a small proportion of the total fisheries, but it appears that bottomfish are comprising a relatively higher percentage of the trip revenue on trips where bottomfish were caught.

Figure 6. NMI bottomfish catch in average pounds per trip



Year	Pounds per trip
1983	43
1984	69
1985	116
1986	104
1987	168
1988	179
1989	76
1990	85
1991	46
1992	58
1993	83
1994	74

Calculation: The average catch per trip is calculated by dividing the total weight of all bottomfish landings by the number of trips which landed bottomfish, regardless of the amount of bottomfish landed on any given trip. Although the average catch per trip is not a very good measure of CPUE, because it is subject to significant biases (e.g. changes in trip length and relative amounts of bottomfishing compared to trolling), it is the only measure readily possible from the commercial landings system It may be possible to improve this measure of CPUE by using only those trips which landed bottomfish exclusively, but that has not yet been done. It is believed that the sample size resulting from this exercise would be extremely small and subject to other biases. It should, however, be investigated in the future.

Interpretation: Even though bottomfish effort and landings are increasing slightly, the revenue obtained from bottomfish sales is relatively stable. This may be a function of the bottomfish fisherman trolling to and from the bottomfishing site, thus having a mixed catch after spending the day "bottomfishing".

Appendix 5. NMFS 1994 Administrative Activities

Northwestern Hawaiian Islands Bottomfish Fisheries

The northwestern Hawaiian Islands (NWHI) bottomfish fisheries, which come under a Federal permits program administered by the NMFS Southwest Region, consist of two permit areas: Ho'omalu (limited access) and Mau (open access) Zones. In 1994, the Southwest Region issued a total of 27 NWHI bottomfish fishing permits, of which 7 were for the Ho'omalu Zone and 20 for the Mau Zone. In addition, 4 persons were determined to be eligible for Ho'omalu Zone permits but had not been issued permits by the end of the year.

The number of persons holding or eligible for Ho'omalu Zone permits increased by six over the previous year, with new entries into the limited access fishery by vessel holders who had been eligible, but postponed applying for a permit until the end of 1993 (i.e., 'grandfathers'), as allowed under Amendment 2 of the fishery management plan. Two of the permit holders were without vessels; one vessel (the F/V Anna Riley) had sunk in 1993 and no replacement vessel had been found; in the other case a new vessel was being constructed for entry into the fishery in the near future. Two vessel owners were deemed eligible for permits but the vessel operators had not completed the Protected Species Workshop, a requirement of permit issuance.

Mau Zone (open access) vessels:

1. Aikane 49
2. Amber Rose (new)
3. Boomerang
4. Crystal (new)
5. Dasher II
6. Honua-Oe
7. Imua
8. Iwalani
9. Jamie Elizabeth (new)
10. J-Natsuko-O
11. Jenine
12. Kai Pali (new)
13. Kasatka
14. Kealailani (new)
15. Lisa I
16. Malia C
17. Sea Eagle
18. Vostok
19. Wahine Kapaloa
20. Wahine Kapaloa I (new)

Ho'omalu Zone (limited access) vessels:

1. Anna Riley (sank in April 1993)
2. E.T.
3. Fortuna
4. Four C's (new)
5. Justin G (new)
6. Kaimi Kai
7. Laysan
8. Pursuit (new)
9. Trident (new)
10. Windwalker (new)
11. "replacement vessel" for the Tiare (new)

Appendix 6. NMFS 1994 Enforcement Activities

The following report is a combined effort of the U.S. Coast Guard 14th District and the NMFS Southwest Region Office of Enforcement. The report covers the period 1 January 1994 through 31 December 1994.

There were two significant MFCMA law enforcement cases relating to bottomfish/ seamount groundfish fisheries that were prosecuted by the Coast Guard in 1994. The following information applies:

In June 1994, a Coast Guard C-130 sighted an underway Japanese stern trawler, the TOMI MARU NO. 58, just outside the U.S. EEZ boundary near Hancock Seamount. Close review of photographs and videotape indicated that the foreign trawler had recently been engaged in fishing.

In October 1994, a Coast Guard C-130 sighted the Japanese stern trawler KYOWA MARU NO. 1 illegally fishing approximately ten nautical miles inside the U.S. EEZ at Hancock Seamount. The vessel immediately departed the U.S. EEZ after being sighted. Working with the vessel's owners, the KYOWA MARU NO. 1 subsequently proceeded to Midway Island for a one day investigation into the incident. Following a joint Coast Guard/National Marine Fisheries Service (NMFS) boarding at Midway, the KYOWA MARU NO. 1 was issued a Notice of Violation which was settled for $90,000.

The Coast Guard continues to conduct surveillance of the Hancock Seamount area. The Coast Guard utilizes C-130 aircraft and cutters to patrol the Northwest Hawaiian Islands/Hancock Seamount.

Appendix 7. Protected Species and Habitat

Protected Species

Twenty-three (23) bottomfish vessel operators completed the one-time Protected Species Workshop required to validate permits for the Ho'omalu and Mau Zones in 1994.

One accidental hooking of a Hawaiian monk seal was reported from the Ho'omalu Zone in 1994. The seal reportedly took the catch (uku) and was hooked in the lower jaw. The leader was cut leaving about 12-18 inches trailing. No other injuries were observed on the animal which otherwise appeared to be healthy.

The seal has not been seen with the hook or leader since, but HL field teams will be on the look out for it this season.

Habitat Conditions and Recent Activities

Under the bottomfish FMP, regulations were implemented to prohibit the use of bottom trawls, bottom-set nets, explosives and poisons for harvesting bottomfish. This has served to greatly reduce the potential for bottomfish habitat degradation. To our knowledge, there have been no violations of these regulations in 1994.

As reported in earlier annual reports, there are several activities occurring, or reportedly occurring, in the EEZ that may potentially alter bottomfish habitat. These include:

1. Anchor damage by vessels attempting to maintain position over productive bottomfish habitat.

2. Habitat damage from heavy weights and line entanglements during normal hook-and-line bottomfish operations.

An activity which potentially may impact bottomfish habitat is a proposal to lease 26,910 square kilometers of the EEZ surrounding the Hawaiian Archipelago and Johnston Island for mining of cobalt rich manganese crusts. A joint State-Federal Task Force, which includes a staff member from the NMFS Habitat Conservation Program, has developed an environmental impact statement (EIS) for the proposed activity. A research cruise was conducted in 1994 which collected 2,500 pounds of crust samples from the EEZ of Johnston Atoll. The samples are presently being analyzed.

A permit modification for the Johnston Atoll Chemical Agent Disposal System (JACADS) is being requested by the U.S. Army. The modification would allow an extension of operation time beyond five years, the amount of time originally permitted for JACADS

The Hawaii Geothermal EIS Project was initiated with contract work ongoing to provide data needed to prepare the Federal EIS. NMFS was a cooperating agency in developing the document, primarily because of concerns about potential impacts from the interisland electrical transmitting cable system on marine biota and habitats. In May 1994 the Department of Energy withdrew from the EIS Project, stating that Hawaii was no longer pursuing the project as originally proposed. The project is essentially dead for the immediate future.

On October 14, 1993, the Taiwanese longline fishing vessel F/V *Jin Shiang Fa* ran aground on the reef along the western side of Rose Atoll, American Samoa. The vessel spilled an estimated 100,000 gallons of diesel fuel, 500 gallons of lube oil, and 2,500 pounds of ammonia. In November, NMFS participated in a multi-agency Natural Resource Damage Assessment of the atoll. Damage from spilled fuel products and physical damage from the vessel and gear was documented within the lagoon and on the outer atoll reef to a depth of 150 feet. Follow-up damage assessment continued through 1994 with two additional research cruises. Further monitoring is planned for 1995 since damage to the reef was far more severe than originally projected.

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